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*On the cover: The PV-2, MECHANIX ILLUSTRATED kodachrome by Louis Hochman*

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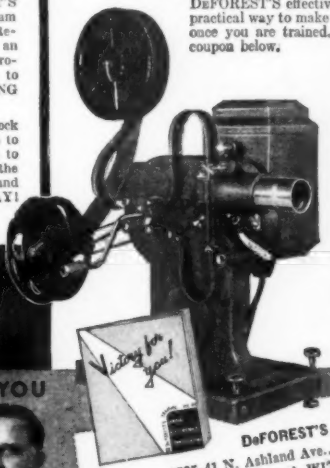


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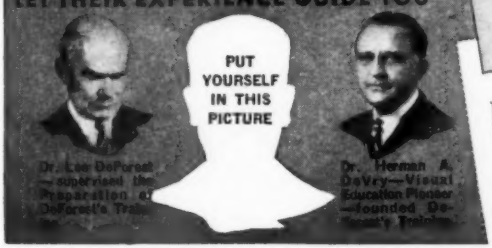
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# YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

## Safe Utility

Roland D. Roecker, M. D., Millington, N. J., has designed a device for use by psychopathic patients and wants an expression of opinion.

ANSWER: *We believe that even the disclosure of the intent and purpose of the article you described would stimulate the production of many modifications of your plan.*

*In accordance with our policy not to disclose details of inventions which we consider worth while, and stretching that point even further in the present case, we are omitting all direct reference to the article itself.*

*In our opinion, this item is a worthy contribution. Every effort should be made to investigate its inventive status.*

*It is unfortunate that there are so many different ways in which the same end-purpose can be attained. In fact, using a wrench on most of the screw-type items now on the market would give the expected results.*

*You may be able to convince the control boards of the need of these hospital regulated items. They might be considered a war necessity and on that basis manufacture would be allowed even today. Nevertheless, the use for such an item in asylums and prisons will be present even long after the war. We believe that action is indicated and we hope the protection can be made broad enough to cover every conceivable type of locking mechanism.*

## Automatic Bomb-Automatic Torpedo

Pvt. L. P. Webster, Camp Crowder, Missouri, submits a very general suggestion relating to a bomb, the direction of which could be controlled by "static electricity developed by an airplane generator," and also a torpedo whose direction could be controlled by the noise made by beating propellers of a ship.

ANSWER: *Most military aircraft have circuits so completely shielded that any "static" is effectively grounded. If this were not done the manufactured "static" would interfere with the radio receiver on board the plane. There are more effective methods of controlling the direction of the powered bomb than the one you outlined.*

*Using sound as a means of steering a torpedo toward its objective was proposed and developed during the first World War. You have added nothing new to the scheme.*

## Prolific Inventor

Alcide D. Morin of Beverly, Mass., states that he has developed a method to double the mileage from a gallon of gasoline; that he has a shock-proof electrical fixture; that he can make all electrical appliances shock-proof; that he has developed a new lifetime electrical fuse and an automobile equalizing transmission. He states that he requires financial help to develop these inventions.

ANSWER: *You have merely given us a statement of theoretical values. There is nothing in your communication to indicate that any of these ideas have gone further than just thinking about them.*

*Any of these inventions should find an immediate and profitable market. The cost of a patent is nominal. We believe you should be able to protect at least one of them and utilize the profits therefrom for your other inventive efforts.*

## Window Lock

D643992 Spr. Parent H., Halifax, N. S., states that he has a simple gadget to lock a window at any desired point. He wants our advice.

ANSWER: *Your letter contains no disclosure, and consequently we cannot comment specifically. Hundreds of different ideas on window locks have been developed which perform the same service as the one you propose. Your unit may be better than any on the market, but you must furnish details for our estimation of values.*

## Gasoline Engine

Edward Luebke, Grand Island, Neb., writes that with the same stroke, bore, compression, and r.p.m. his modified engine will develop 85 horsepower instead of the conventional 70.

[*Continued on page 157*]

# INVENTORS

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# CHIPS *from the* EDITOR'S WORKBENCH

### *Contest*

WE'RE off to another rip-roaring Buildwords Contest this month—our Fourth Annual clambake of this kind. We know all of you are going to get a kick out of it. Remember, this is a contest for MI readers, designed especially for you people with inventive, inquiring minds. Skill alone will win. No "fancy-pants" entries will receive more attention than plain entries. There aren't any slogans or essays to write. Just have yourself a whale of a good time playing this fascinating game, then send your three puzzles in to us when you've finished them. There's no reason why you can't win that great First Prize of $1,500 in War Bonds, or the $750 War Bond Second Prize, or the $500 War Bond Third Prize—or at least one of the 100 valuable awards! So sharpen your pencil now and get going!

### *Lend-Lease Boys*

THE boys who are bombing Berlin are getting all the glory insofar as bombers are concerned in this war. But there are TWO kinds of bombing: 1. Strategic (which is the mass bombing of the enemy's back-of-the-lines factories and centers of production) and, 2. Tactical (which is bombing in support of ground troops). The tactical bombing boys have come to be known as "The Lend-Lease Boys," because they are available for the British ground troops as well as the Americans, whenever the urgency of the moment calls for them. An American tactical bomber pilot who operated in North Africa, Sicily and Italy explains the mysteries of his job to you in one of our best features for next month, "We Bomb the Tactical Hell Out of Them." Look for it in the March MI.

**RUNS ON A STARTER**

**Tom Disher, Ridgeway, Ont., built this little electric car. An ordinary storage battery provides the juice, and an automobile starter provides the power. As Tom has his own battery charger, it is a simple matter to "refuel" the car each night. A $5.00 Workbench award and a Certificate of Merit go to Tom for this snapshot.**

### *More Color*

Your favorite magazine is blossoming out like a real rainbow in this issue. When you turn to the Crafts And Hobbies Section, you're due for a very pleasant surprise. For there, to supplement the red color which has been used in the front half of the book for some months, is a splendid blue, both "solid" and in tones. It's going to make the pages look better than ever, and help bring out the drawings and diagrams to maximum advantage. This represents just one more step in our efforts to bring you a constantly improved magazine. We hope you'll like it.

### *Start 'Em Flying!*

The industry most dangerous to the Axis is the safest for American workers.

This, says the Aircraft War Production Council, coordinating agency for the seven major West Coast aircraft plants, is the gist of the U. S. Department of Labor's annual report on industrial injuries insofar as it applies to warplane plants, which the government credits with the lowest accident rate of any comparable industry.

Frequency rate of injuries among airplane workers in 1942, the government report showed, was 11.4 per cent.

Streamlining of warplane plant operation and production methods, embracing work simplification, labor utilization and general raising of plant efficiency has contributed to the establishment of this new record, the Council commented.

This record was achieved concurrent with changes in model design, rescheduling to meet the demands of the armed forces and a critical manpower situation, all of which made the maintenance of safety controls a more involved operation.

Among other major war industries, the labor department report showed, injury rates were 33.1 per cent for shipbuilding, 40.7 per cent on structural steel fabrication, 17.4 per cent on railroad equipment manufacture and 89.6 per cent on logging.

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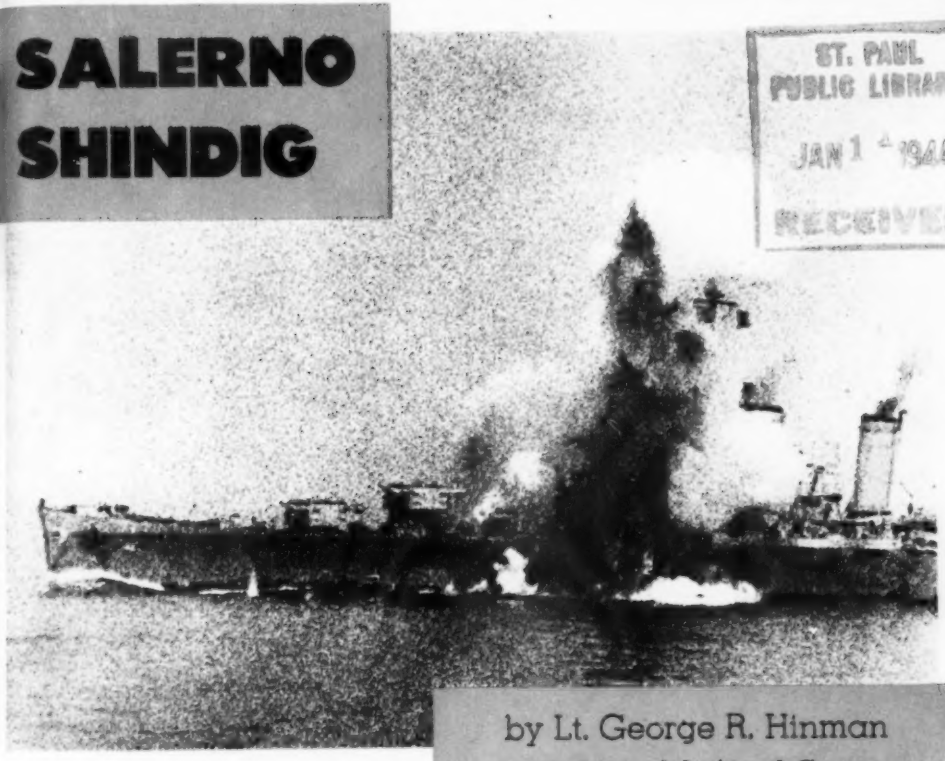

The enemy bomb hit on a gun turret of the Cruiser Savannah, as witnessed by Lt. Hinman on his close by Victory ship in Salerno invasion.

by Lt. George R. Hinman
as told to Michael Stern

OUR first wave of picked troops slipped into Salerno harbor in the early morning hours of September 9, 1943. They climbed down landing nets into Higgins boats and started toward a dark, ominously quiet Italian shore.

It was H-hour on D-day. From the lips of thousands of doughboys came the words they always speak before going into action: "This is it." The invasion of the European continent had begun. Minutes ticked slowly by and the tension grew unbearable. The invasion barges would not come back until every man had landed—or died in the attempt.

There had been no intensive aerial and naval preparation for the assault as we had had in the North African and Sicilian invasions. The Italians had signed a secret armistice with us and we were hoping—praying—that this would mean an unopposed landing.

Suddenly the night was split by countless flashes of red and gold flame. Streaming tracers criss-crossed the beaches in a murderous pattern of fire. The barges that took in the first wave were overdue when the second wave, keeping to the invasion timetable with split second accuracy, went over the sides and moved rapidly toward the deadly beach. The first and second waves of landing craft were overdue when the third went in.

It didn't seem possible that anyone could survive a fire that raked every inch of beach, and every man still aboard the naval craft believed the worst had happened—believed it, that is, until the boats that had taken in the third wave returned and told that their men had penetrated the deadly curtain of fire. They were first to make land and dig in and with their fire had covered the landing of groups one and two. Our re-enforcements poured onto the bloody beach-head on D plus one, but the Germans were so strongly entrenched that our foothold was in almost hourly peril.

The ship on which I was communications officer came into the Salerno harbor at D plus



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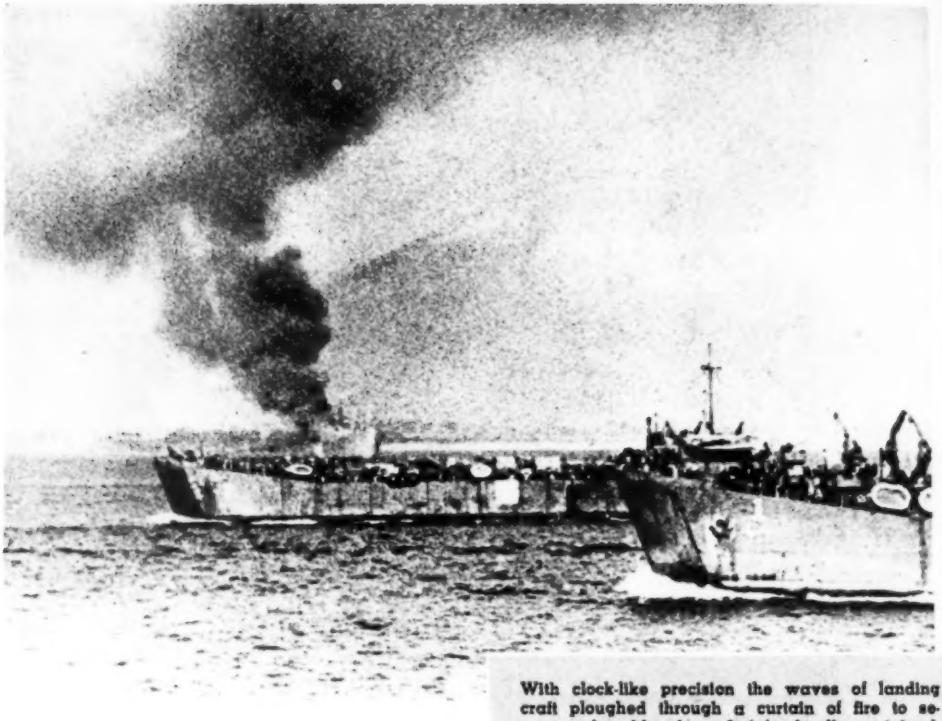


**With clock-like precision the waves of landing craft ploughed through a curtain of fire to secure a beachhead on Italy's deadly mainland.**

two. Ours was a victory ship carrying part of an armored division and its equipment which was to be thrown into immediate battle. As we came in, nearly 100 large ships rode at anchor. Hundreds of LCT's (landing craft for tanks) and LCI's (landing craft for infantry) were scurrying back and forth between freighter and shore. From the hazy semi-circular line of hills I could see light murky smoke showing where enemy gun batteries were firing and a heavy white phosphorescent smoke screen close to the line of the shore. No enemy shore batteries opposed our coming. These had been blown out of their emplacements on D plus one by the heavy guns of the British-American cruisers and destroyers.

We knew Salerno would be no picnic and as we steamed into the harbor every man was at battle station. In action I serve as aircraft spotter and I stood on the flying bridge which circled the smokestack, power glasses glued to my eyes scanning the sky for enemy planes.

We were just passing alongside the American cruiser Savannah when I caught sight of a lone plane so high in the sky that I couldn't identify it. I saw it make a slow, wide circle and nose down. In a matter of seconds I could see its outline. It was a single-motored fighter, but I couldn't be sure whether it was a Spitfire or a Messerschmitt 109E because they resemble each other. A split second later, however, I was sure.

"Enemy plane," I called.

Radioman Eugene Weideman relayed the message through the gun phone. Anti-aircraft shells flew into the sky at an astonishing rate, exploded into black blossoms. Every gun on the cruiser was pouring flame at her. The German fighter, a single five hundred pound bomb strapped under its fuselage, came in on the Savannah like a dive bomber and released its load from low altitude. The bomb nosed down at an angle and made a direct hit on a gun turret. There was a sudden surge of flame that flared like the striking of a sulphur match and a billowing cloud of black smoke engulfed it.

As the smoke lifted I saw the rescue crew race along the deck and climb into the turret dragging fire hoses after them. They could not have known when the ammunition would go off. Quite obviously they didn't seem to care. They had a job to do and they did it

without a second's hesitation. While the other guns aboard the cruiser were streaming fire after the receding tail of the Messerschmitt the rescue squad brought the dead and wounded out of the turret and put the blaze there under immediate control.

The Victory—for reasons of Naval security I must give the ship on which I served a fictitious name—dropped anchor a half mile from shore and immediately began to put equipment over the side. Some of the stuff was amphibian like the ten and one-half ton trucks which are nicknamed "The Ducks." We deposit them on the water and they just set off for shore under their own power.

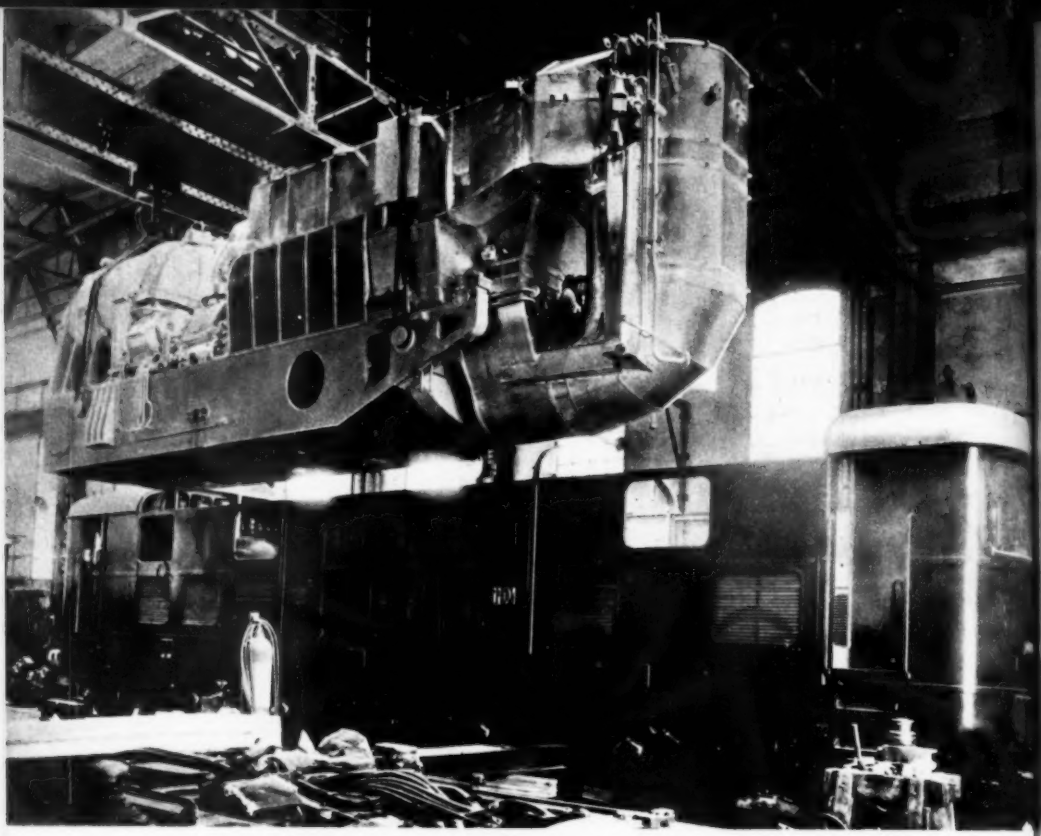
From the flying bridge I had a clear view of the battleground. We occupied the flat plate of beach. Wooded hills rose sharply behind it. The Sorrentine Peninsula jutted an arm into the Gulf of Salerno and on the craggy heights of its Lattari Mountain, Nazi .88 millimeter guns were studded. Mountainous Licosa Point had peaks as high as four thousand feet and from them heavy caliber field pieces poured shells on the soldiers below. I could hear the heavy whoomph of artillery pieces and the brisk chatter of small arms as the relentless struggle went on.

The warships of the Allied nations did a beautiful job. Steaming slowly in the roadstead a few miles behind us, they sighted on the German batteries and all day long salvos from their long range cannon lobbed shells over our heads and into the hills. The shells travelled with such unerring accuracy that position after position was blasted into eternity.

Our soldiers ashore were too busy to give us much of a hand at the job of unloading so it proceeded somewhat slowly and laboriously. We knew how desperately every bit of equipment was needed and we did our best to get it where it would do the most good.

Shortly past noon six JU 88's picked us out for their special target. We must have looked like an easy mark because they came in on a low level attack. Every gun on our ship—and we had so many the Nazis must have wondered whether or not they were making a mistake in figuring us for a freighter instead of a warship—opened up with a withering hail of fire. We must have rattled the Nazis because they jettisoned their bombs and zoomed for altitude. [*Continued on page* 82]

**Litter bearers comb the Salerno beach for casualties. The inferno of Nazi fire was silenced by wonderful shooting by the allied warships.**



A gas turbine engine being installed in the first locomotive to be so powered.

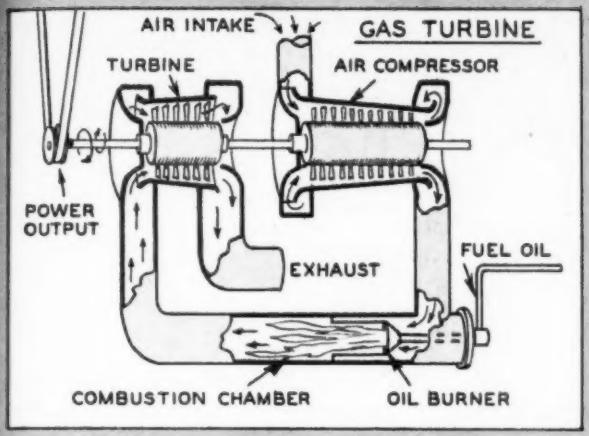
# REVOLUTION IN POWER: THE GAS TURBINE

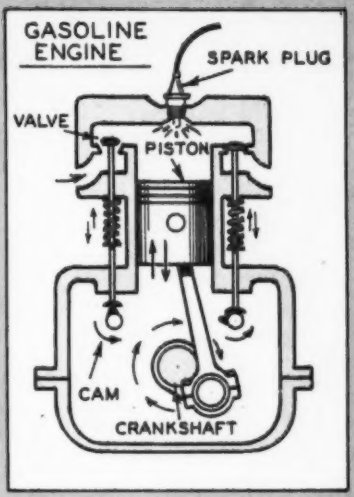
by Ben Hardy

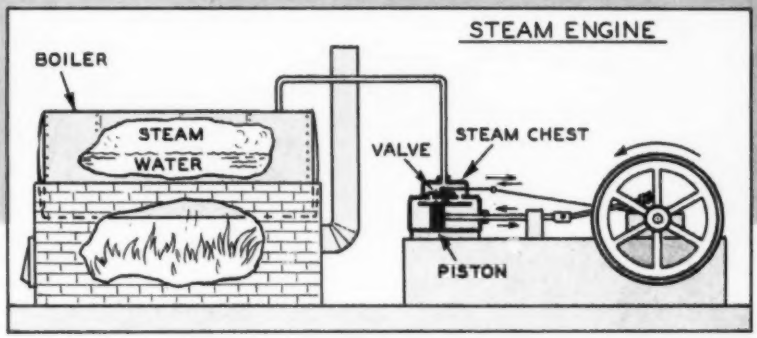
BACK in 1939, without fuss or fanfare, the the sober citizens of Neuchatel, Switzerland, dug a deep hole in the heart of their trim municipality. After they had lined it with sturdy concrete walls they reinforced the tunnel-like enclosures until it was bombproof and carefully camouflaged the locality. Then, with the tidy workmanship for which their pocket-size nation is noted, they installed in this impregnable cavern a remarkable piece of machinery, the like of which had never been seen before.

It was that will-o'-the-wisp of countless inventors, a workable gas turbine, harnessed to a 5,300-horsepower generator. In that cramped underground cubicle, hardly bigger than a boxcar, Neuchatel had a standby station which, in the event of damage to the central municipal powerhouse, could feed light and power to all of its 23,000 inhabitants.

This potent and compact bundle of power was nothing short of an engineering miracle. In Neuchatel's streamlined molehill all the bulky paraphernalia of standard power plants



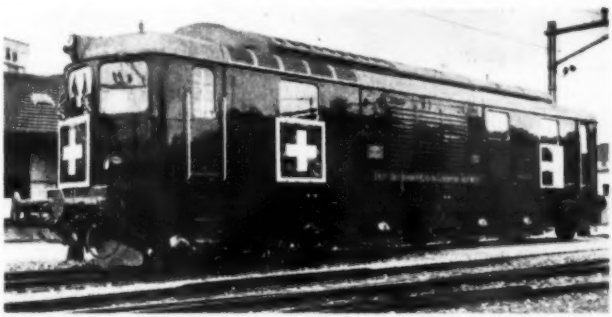




**These three diagrams show the simplicity of a gas turbine as compared to a steam engine and internal combustion. It has only one moving part.**

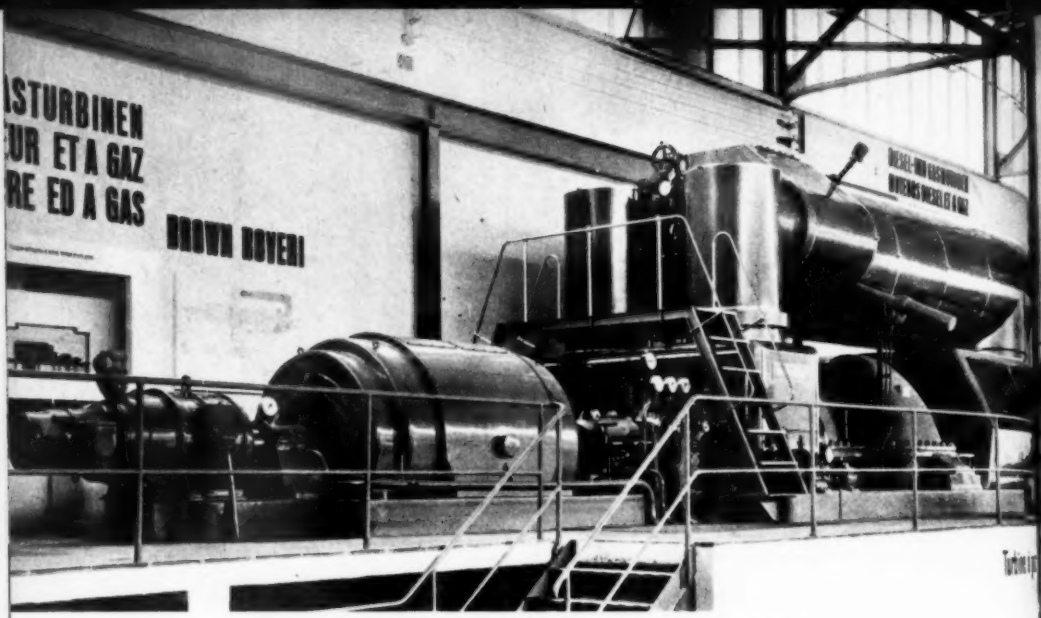
—huge steam boilers, batteries of pumps, jumbled networks of steam and water pipes—is missing. Steam engines and turbines, gasoline engines, Diesels, and other time-honored devices for extracting moving power from fuel are conspicuous by their absence. Neuchatel's dwarfish prime mover, perfected by the Brown Boveri Company of Baden, famous the world over as builders of power machinery, is something new under the sun—a turbine that is activated directly by the power of flaming fuel without first translating it into steam.

There's nothing new about deriving useful power from the direct expansion of fuel-combustion vapors. Forward-looking engineers have been toying with the idea since 1790. But before the gas turbine the gas-expansion cycle found practical use only inside the cylinders of Diesels and other reciprocating engines. The only alternative was unwieldy, hard-to-manage machinery run by steam.

With one clean sweep, the gas turbine eliminates reciprocating motion, the tough



**This exclusive photo shows the first locomotive equipped with a gas turbine engine, built in Switzerland.**




**The Neuchatel gas turbine power unit in Switzerland.**

problems of fuel injection and cylinder lubrication, and all need for a water-cooling system. In essence it's little more than a compartment housing one moving part, a rotor containing thousands of fins. Startlingly simple, it's a giant stride forward from the familiar gas engine, just as the steam turbine, in its day, was from the steam engine.

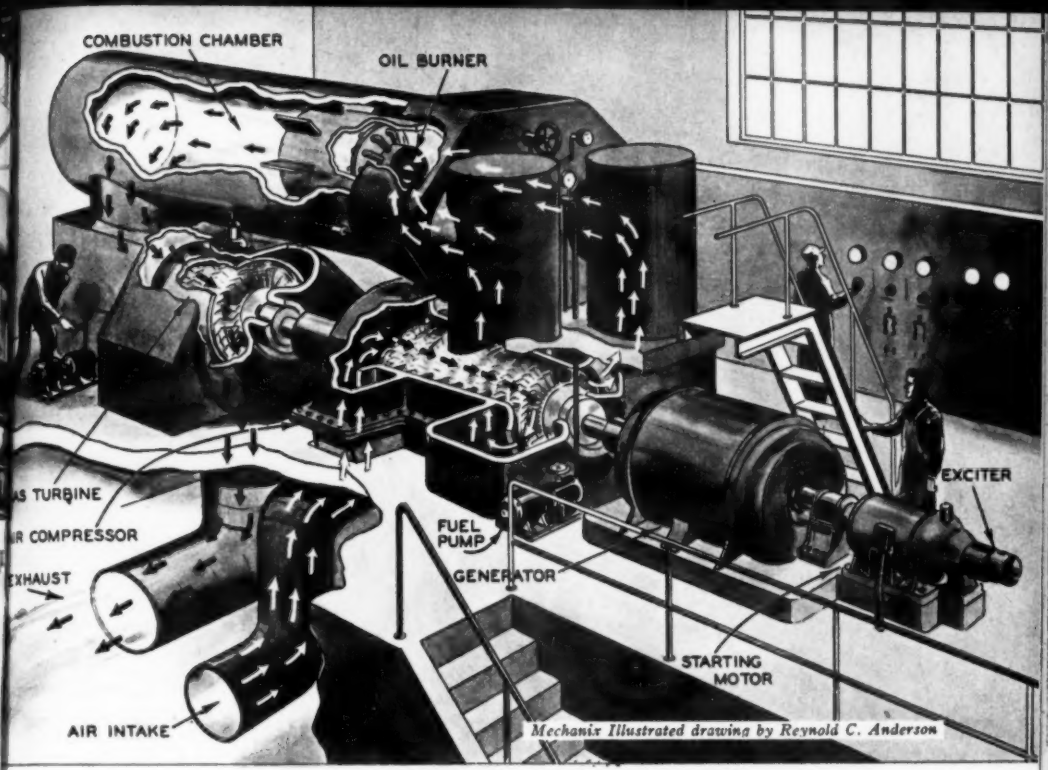
This midget mover, for decades an engineer's pipe-dream, suddenly came of age with its installation at Neuchatel. Since then it has proved its mettle in a dozen different fields. Harbinger of eye-opening changes in the ships, planes, locomotives and power plants of tomorrow, it has already done yeoman's service in the war effort. The much-publicized turbosupercharger used on American fighting planes, which enables engines to keep plugging smoothly seven miles up, is really a gas turbine whose source of power is the waste engine exhaust. Dozens of these pocket powerhouses, with design improvements worked out by Allis-Chalmers, General Electric, Westinghouse, and the pioneering Brown Boveri Company, are today making the wheels hum in American oil-cracking plants and other power-greedy industries.

The old-style steam turbine hurls terrible blasts of live steam against the blades of its rotor, then uses the rotary movement that results to drive other machinery or to generate electrical power. In such set-ups, the hitch comes in providing the huge quantities of steam needed. A steam turbine requires endless tons of water, immense evaporation boilers, massive auxiliary equipment in the form of feedwater pumps, water-treatment plants, and cooling towers. Such installations are costly and difficult to maintain, requiring constant lubrication and scraping of corroded surfaces.

The gas turbine cuts through this elaborate and indirect process. Steam boilers become non-essential frills, their job taken over by a combustion chamber. Like other prime movers, the new turbine is nothing but a propeller in a box. But what makes the propeller spin is the big novelty.

Instead of using its fuel to generate steam, which in turn is fed into the rotor chamber, the gas turbine hurls its flaming jet of liquid or gaseous fuel—gasoline, oil, natural gas, blast-furnace gas, or, eventually, even pulverized coal—directly at its whizzing blades. Expansive power of the heated gases cascading off from the fiery blast imparts tremendous spinning energy to the rotor. If you've ever watched a windmill whirling in the breeze, or puffed out your cheeks and blown hard at a little celluloid pinwheel, you know how a jet of air can produce such rotary action. The gas turbine is merely a gargantuan pinwheel, propelled by vapors which are the products of combustion.

Design of this mighty midget is a model of simplicity. Freed from the headaches involved in producing steam or doping out a complicated system of reciprocating cylinders, engineers have found it possible to build the




**This cutaway shows how the Neuchatel gas turbine operates.**

unit with only three basic parts: a compressed-air blower which heaves out the ignited torch of vaporizing fuel; a combustion chamber through which this tongue of flame blasts its way, giving off billows of hot vapors; and the multistage turbine rotor itself, consisting of several rows of fins so arranged that they squeeze the last mite of energy from the combustion gases that rush through.

Compressed air, under pressure of 30 to 50 pounds per square inch, tears from the blower into the long combustion tube. The scorching flame from the burner, caught up in this high-powered blast, darts along the chamber while clouds of vapor swirl off. Only a fixed amount of air is forced through the blower, to keep the gas-air mixture constant. Excess air is piped into the hollow casing of the combustion chamber to cool the vapors. Temperature must be kept down to about 1,000 or 1,200 degrees Fahrenheit to protect the rotor fins. These fins, precision-made from special alloys to withstand the withering heat, are hit hard by the vapors, and the impact whirls the rotor.

Mounted co-axially with the turbine rotor is the blower, which takes up about three-quarters of the machine's total power output. The set-up thus operates its own compression apparatus, leaving about one-fourth of its power to drive the generator coupled to its main shaft. An average unit, amazingly small in gross bulk, will yield a minimum of 2,000 horsepower for useful work, the equivalent of 1,500 kilowatts of electrical energy.

To set the turbine in operation, a small electric motor is switched on, turning the rotor over at about a fourth of its normal speed. As soon as the oil burner is cut in, the turbine begins to race under its own impulsion. There's no danger of over-speeding. When the rotor shows signs of picking up too much speed, a governor automatically reduces the oil intake, and overheated vapors are bypassed around the turbine blades through a safety valve.

The principle of the gas turbine is child's play, but it took plenty of sweat to get it to work. Metallurgy and, strangely enough, aero-dynamics came to the rescue when engineers struck what looked like a permanent snag.

After working with all sorts of supercharging internal combustion engines, including the Holtzwarth [*Continued on page* 157]

# G. I. INVENTORS

ENEMY bombings, desert dust, immediate need of improvised tools—these are some of the problems ingeniously and successfully met by the Yanks of the Air Force Service Command. Vets of Moroccah, Tunisian, Italian campaigns, they invent and repair on the spot, at times under fire.

For cleaning vital aircraft parts, A.F.S.C. mechanics invented their own steam boiler—out of odds and ends and condemned gas drums.

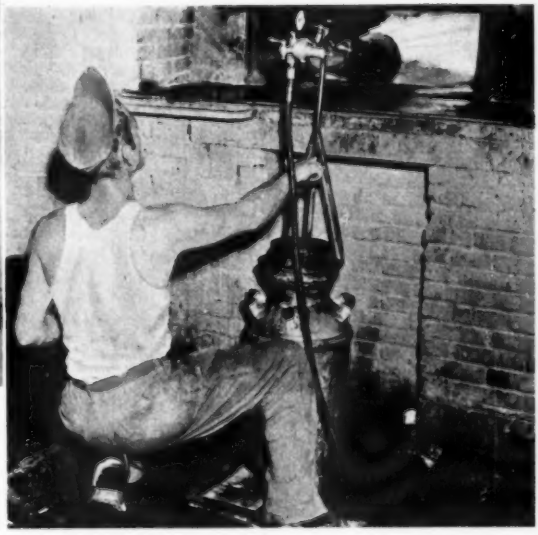
A still? Yes, it is. It was improvised in the desert to provide clear gasoline for cooking purposes. Yes, you push the middle valve down.

Looking like something out of a New England antique shop, this screen crimper is used in the making of dust screens and filters—necessities for combat aircraft in the Middle Eastern Theater.

A jeep totes an extensible ladder to tail of a B-17 bomber, for speedy repair. G. I. geniuses built this ladder.

A former chemist and a former tuna fisherman straighten crooked propellers by using Army truck bumper.

Two hours after an operations "tower" was bombed to bits, A.F.S.C. men had this unit guiding our war planes.

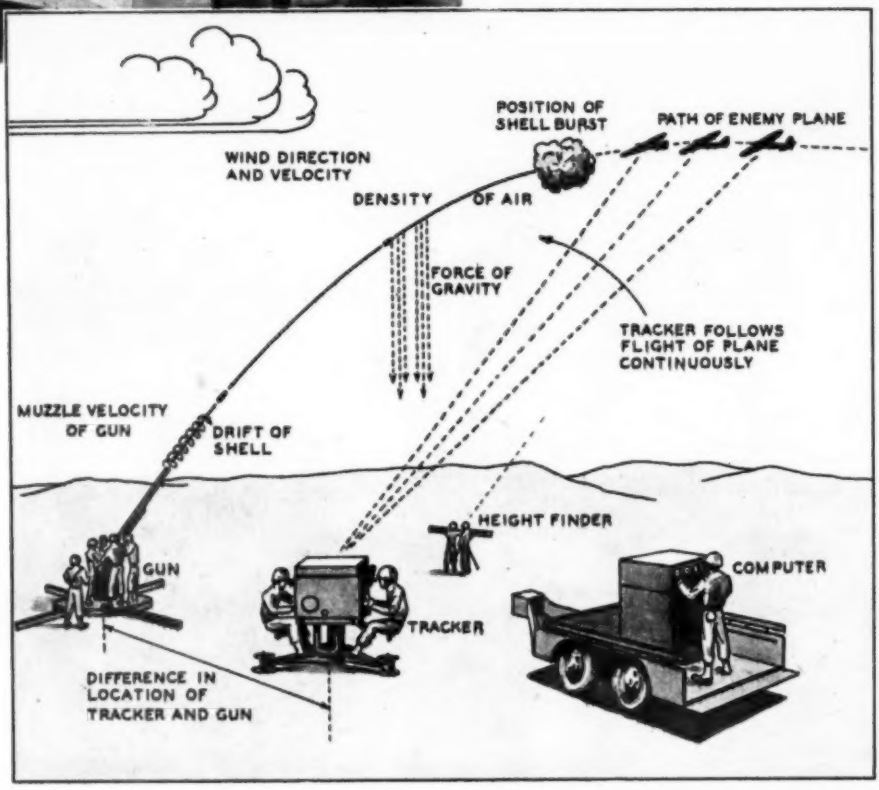


A homemade blow torch preheats an oven. If torch is used for half an hour, oven stays hot for 90 minute baking.

# ACK-ACK BRAIN

IN THE sketch below, an electrical brain, called the computer, absorbs the facts given it by the tracker and the height finder—is aware of all the other data given in the sketch (anti-aircraft ballistic problems)—and then directs the gun on when and where to fire. The electrical information given out by the computer is translated into mechanical movement at the gun to swing its muzzle automatically to the correct vertical and horizontal angle to blast the enemy plane. While operating continuously during the tracking period, the computer is able to make instantaneous corrections of any changes in the vital data. All the Army would say about its new advance in the art of fire control, the M-9, was that it enabled ack-ack to tear target sleeves to shreds.

**At left—in foreground is the computer. The operator tracker can be seen in background.**



# MODEL T OF HELICOPTERS

by Bernard Wolfe

**First ship of its kind, the PV helicopter's rotors fold up so that it will fit into any garage.**

ONE brisk day back in October, a dapper, broad-shouldered young man made his way across the Washington National Airport to a toy-like little ship, followed by more than one pair of skeptical eyes. Still in his twenties, with a jaunty homburg slanted back on his head, the fledgling pilot looked more like a gridiron husky than one of the 20 crack engineers in America who understand helicopters from the ground up. The military and civilian observers awaited the demonstration of this latest cloud-hopping jeep, with mixed feelings.

As the assembled experts well knew, helicopter flying isn't child's play. It taxes the pilot's nervous system severely. Young Frank Piasecki, far from being a veteran airman, had to his credit a meager 14 hours in a Taylor cub, just enough to entitle him to a student permit. Worse yet, he had chalked

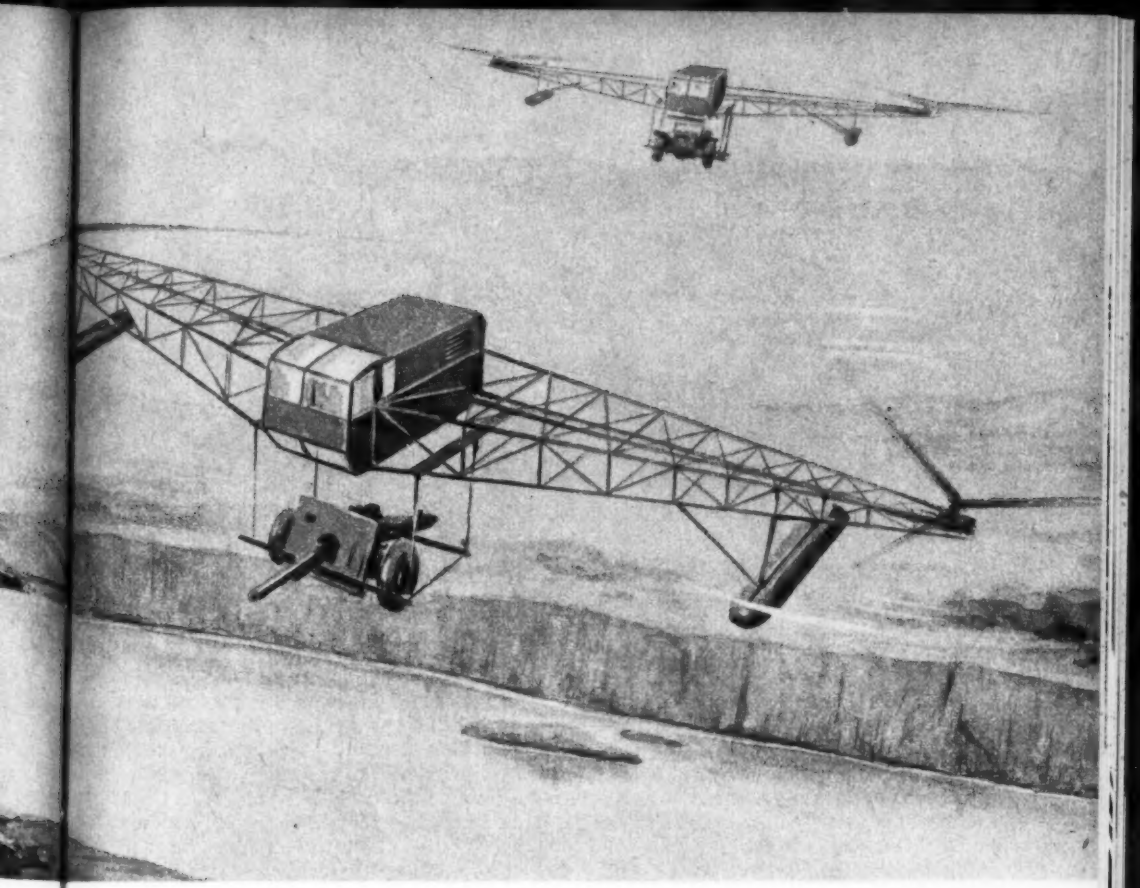
In his research, Piasecki, PV designer, unearthed reports that Germans were using oversize helicopters to carry guns and other equipment across unfordable streams, as shown in the artist's conception by MI's Fred Ripperda, above.

up a mere 16 hours of flying time in helicopters, and was the first American to be granted a helicopter license without first qualifying for the regular airplane pilot's license.

Under the circumstances, this test was doubly important. There would be no old hand at the controls of the new ship to cope with a wobbly stick, vibrations, or any other defect which might pop up under the stresses and strains of flight. If the PV-2 turned in a good performance with such a novice in the cockpit it would speak volumes for the safety and controllability of the new flying windmill.

The experts watched Piasecki climb into the absurd, flimsy-looking little ship with misgivings. How would such a fragile dwarf of a ship, newcomer among rotary-wing ma-

Front view of the PV's controls, showing extreme simplicity of design. Piasecki's left hand grasps throttle.



A closeup of the rotor control. In Piasecki's right hand. The ship goes in any direction the lever is moved.

chines, fare in the hands of this cocky amateur?

The ship itself was a gawky affair, tiny and compact, looking like a hunched bumblebee poised for the takeoff. Like the Sikorsky model, it was equipped with a main horizontal rotor overhead and a smaller auxiliary rotor attached sideways to the tail, but it looked much lighter, smaller and infinitely less substantial than the VS-300. What it would do in the air was anybody's guess.

There was no cause for alarm. Once Piasecki had slipped into the cockpit of the single seater, the rotors began to hum with an angry whir and the machine rose vertically. It hovered a few feet off the ground, climbed higher and turned smartly in its own length, with the absurd assurance of a circus midget. With the ease of an old campaigner Piasecki flew forward at a good clip, backed up, banked, turned sideways and descended vertically to hover again while the news photographers clicked their shutters. The

**This photo shows the smallness of the PV-2. Piasecki uses the old-fashioned automobile horn mounted on the lower strut to warn off pedestrians as he lands.**

oldtimers in the audience sat up and took notice. The demonstration had gone like clockword.

Later, with the same good-natured nonchalance, the young designer took off from a private driveway in Falls Church, Va., and buzzed down the street to a gas station. There he waved three fingers to an attendant, who filled up the gas tank and wiped off the windshield. Taking off again, Piasecki flew to a nearby golf club, landed at the first hole, and proceeded to tee off with his waiting friends, much to the delight of the newsreel cameramen who trailed along to record the feat. "I just wanted to show it could be done," Piasecki explained later with a grin. "There's been a lot of talk lately about how you can land in tight places with a 'copter, but nobody's got around to actually doing it. I thought you fellows might like to see that it's more than high-powered talk." The gas-station clearance in which he had landed was so laid out, with a treacherous two-foot fence enclosing it, that hardly more than 25 square feet were available to Piasecki when he inched his way in. Both ship and pilot, despite their tender years, had turned in a performance as smooth as silk.

Although there are upwards of 26 rotary-wing aircraft projects now on the boards or under construction in this country, Piasecki's PV-2 is the second helicopter to get into the air for a full-fledged, all-out demonstration spin. First ship of its type to be fully streamlined (it was styled by Harry S. Pack, helicopter expert for Pennsylvania Central Airlines), it has a gross weight, including pilot and fuel load, of only 1,000 pounds, and in storage, with the three blades of its 25-foot main rotor folded back, it is only 22 feet four inches long, seven feet seven inches high, and eight feet wide. Main rotor blades hit a tip speed of about 350 miles per hour; the ship has a landing speed of zero, can cruise at 85 miles per hour and back up at 20 miles per hour. When it is travelling at a forward speed of 50 miles per hour, the PV-2 will climb at a rate of 1,000 feet per minute, which is about as fast as the ascent of a Taylor cub. If forward speed is eliminated to make the climb directly vertical, the rate is about 600 to 700 feet per minute.

This lilliputian single-seater, even as it stands now, is more indicative of the postwar low-cost helicopter than any other model thus far revealed to the public. In its present form it is a finished vehicle, looking very much like the aerial counterpart of the sport coupe—the Model T of the skyways. With only slight alteration of its dimensions, including some added area to the rotor disc, and a little stepping up of power, the craft can easily be designed to accommodate two, three, or four passengers. The PV midget is the closest thing to a sky-riding runabout that we've seen yet.

In its main features the PV's mechanism resembles that of the Sikorsky and other

models of orthodox two-rotor design. But, while lift and control principles are conventional, new design details simplify the mechanics of operation and make the craft extremely easy to handle.

On the pilot's left, over in a corner, is a ratchet lever, something like an emergency brake in appearance, which controls the "total pitch" of the main rotor's blades—the constant pitch at which all the blades make the complete revolution. The pilot can either operate the throttle independently or adjust it to work automatically with the total-pitch lever, as he prefers. On the other hand, "cyclic pitch"—the pitch of each individual blade, which can be varied in different phases of the revolution, imparting a dip to the fuselage in one phase and a lift in the opposite phase—is adjusted by the main control stick, a long rod which curves down vertically from overhead. This stick is pushed in whatever direction the pilot wishes to travel: forward to go ahead, sideways for movement to right or left, and backward for movement to the rear. All this stick really does is to make the blades bite deeply into the air in one phase, lifting the craft on that side, and bite shallowly in the opposite phase, depressing the body on that side. Movement will follow in the direction of the tilt. With an overhead stick, rather than one that comes up between the pilot's knees from a slot in the floor, there is more room in the cockpit and it is easier to keep clean.

So carefully has the rotor been designed, with its blades balanced exactly against each other as well as absolutely, that there is no vibration or wobble in the control stick, and a minimum of strain is imposed on the pilot. It is because of this ease in control, cutting nervous effort down to next to nothing, that a novice like Piasecki could fly the PV without prior helicopter experience. As a matter of fact, Piasecki can boast that he test flew his ship back in March at the same time that he was learning to fly any kind of helicopter.

Rudder action in the craft is supplied by a five-foot torque propeller, which is shaft-driven, where as the Sikorsky rear rotor is turned by a belt-drive. As in all helicopters of this type, the auxiliary rotor is necessary to offset the torque or twisting effect of the main rotor, which, if not counteracted, would swing the fuselage in circles in a direction opposite to that of the main rotor's blades. (The De Bothezat co-axial helicopter meets this problem by having two main rotors mounted on the same axis, one above the other, revolving in opposite directions at the same speed so that their torque effects are cancelled out.) When movement directly forward or backward is desired, the blades of the rear prop are pitched, or "feathered," by the foot rudder bars just enough to cancel out the torque effect of the main rotor. As a result, there is no turning motion, and the ship goes straight ahead or backwards, depending on whether the control stick is moved forward or back. When movement to one side is desired, the control stick is pushed in that direction and the appropriate foot rudder bar is pressed down—left for left, right for right.

The Franklin four-cylinder, air-cooled engine used in the PV-2 is a 90-horsepower job, of the 180-degree opposed flat type. This engine is mounted with its crankshaft upright just rearward of the cockpit. In order to stand the engine on end, Piasecki and his engineering staff had to work out a special oil scavenge pump under the engine. To cope with the reduction gear problem, Franklin and Lycoming are said to be working right now on a vertical engine specifically for helicopters.

Although most of the design features which reduce vibration in the PV and simplify its controls are secret, it has been revealed that the movement of the engine in its rubber mounting is absorbed by a universal joint placed in the drive shaft between the rotor hub and the gear take-off. About five percent of the engine's power is consumed by the centrifugal cooling blower mounted around the clutch assembly—blower cooling is essential, since the craft eats up full power for sizable periods even when standing still. At present the PV has a ceiling of 5,000 feet and can hit a top speed of 90 to 100 miles per hour, but Piasecki is confident that these limits can be raised without much trouble. "We haven't been worrying about speed and ceiling," he says. "What we wanted to do from the beginning was to simplify the controls and increase the safety factors. By spending ten times the usual engineering time on each design detail, we've pretty well licked the problems we set out to tackle. Later on, when the problems come up, we can fool around with speed, ceiling, passenger capacity, and special automatic safety devices." The thoroughness of Piasecki's engineering is indicated by the fact that the PV has flown successfully, without anything but routine detail changes, since it first took to the air last March.

Piasecki doesn't claim any radical innovations of a general nature—his machine, like most others, utilizes the tried-and-true torque reaction method developed by Von Baumhauer. But his real contribution is a remarkably simplified control. Movement in any direction is obtained by simply moving the control stick in that direction, and the machine can be tilted or rolled on its own axis without any translation. And what is unique is that the time lapse between the stick's motion and the resultant motion in the machine is very much shorter than in previous control systems. This contribution will be a real boom to postwar helicopters, since it makes piloting immeasurably easier. The operator, instead of having to *anticipate* a control motion—which requires laborious practice in timing before he gets his reactions right—now can get an immediate response from any movement of the stick. This innovation brings the helicopter one giant step nearer the capacities of the average man.

Today Piasecki is still wrapped up in wartime

[*Continued on page* 161]

# CONTINENT OF TOMORROW

**A waterway formed by a tributary of the Magdalena River, aorta artery for the fabulously rich heart of Colombia. Location of the Poto gold mine is nearby. A dredge operates on the far river bank.**

by Henry Albert Phillips

YOU may meet one of the luckiest Americans on record, down there in Colombia, South America, when the war is over.

This fortunate young fellow's name is Knight. He was born in Utah, son of a prominent Mormon. When his father died, young Knight found an old trunk in the attic that had belonged to his grandfather. All his life he had been itching to ransack that cowhide covered box, full of relics of grandad's wild adventures in the Colombian jungle. Among the yellowed papers was a document in Spanish. The lad deciphered it and found it to be a deed to an island in the Magdalena River.

Dreaming of treasure, young Knight hurried to New York, there to raise funds and go down to Colombia and open up the land he had inherited. His rounds of the moneyed circles went on for years. Nobody would listen to him. They said it was the old "Spanish Treasure" gag.

Finally, Knight found an investor with ready money. Together they went down to Colombia. They traveled up the Magdalena by hydroplane and located the island deep in jungle. Wherever they went on the island they found evidences of rich resources; from hardwood forests to petroleum seeps.

# NO. 4: COLOMBIA

**Fourth in a series of articles taking you country by country through South America.**

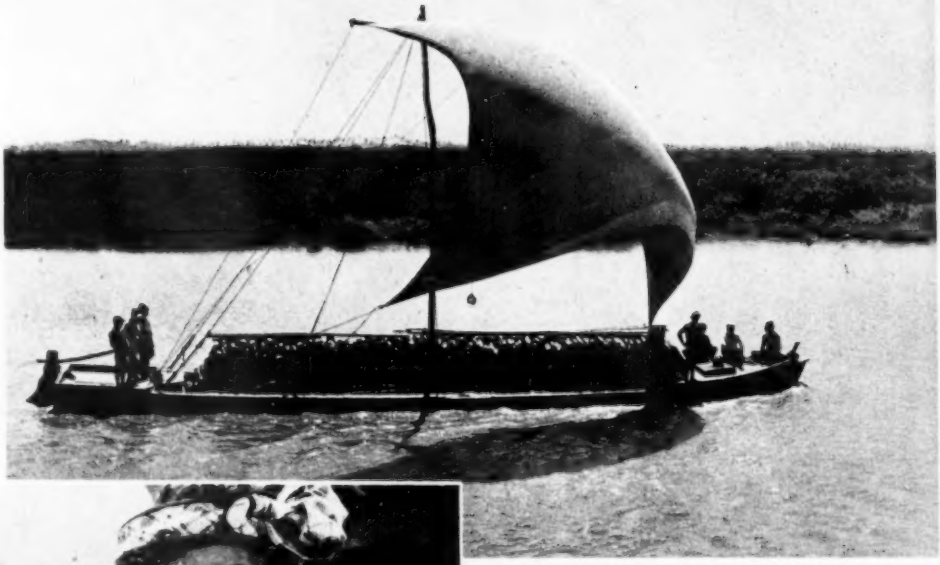
Knight's exciting discoveries were cut short by the war.

Like Knight, you will find Colombia the nearest and easiest country in South America to reach—and the most difficult to negotiate, once you get down there.

Colombia is not a big country, as South American republics go. It is about as wide as the distance between Boston and Chicago; from north to south as far as St. Paul from New Orleans.

After about four to five days out of New York harbor, a Graceliner will let you off at Barranquilla. Now, try to get out of Barranquilla, to explore the rest of the country.

The difficulty lies in the fact that the whole of Colombia is made up of bottlenecks. It is like what would happen to a sandbox if you emptied a barrel of water



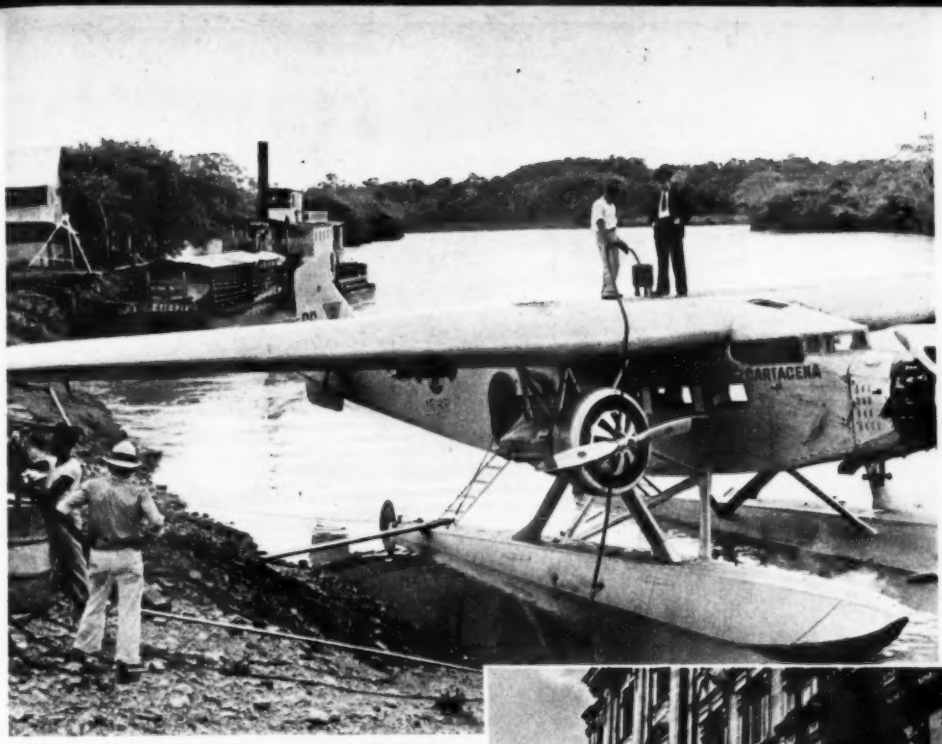
A native sailing barge, picturesque but for fair weather only, floats cargo down the glistening Magdalena River.

There is music—of a kind—in the jungle of never-never land. An Indian plays his mouth violin at Goajira.

into the upper end. It would run over the whole surface in streaks, leaving it all ridges, forming a puddle or sea at the bottom, with a few stagnant streams of water left. Colombia is like that; for the most part a land of high mountain ridges and a single major river—the Magdalena. All points of importance and significance are scattered; each an island, hard to reach with goods and still harder to get them out. For example, you might call Bogota, the Capital, away down south, the political brains and head of the nation; Medellin, nearer the coast the heart or business dynamo; Cali, away off on one side, the religious center or soul; the Magdalena, the artery through which life blood sluggishly flows toward them all, but it reaches none of them. Tiny veins of traffic connect them.

Three courses lie ahead of you, all rich in possibilities.

All trails begin and end at Barranquilla. Barranquilla is a typical Caribbean town—hot, lazy, smelly and filled with black people. You can't easily escape it, because, like all other cities in Colombia, it's a bottleneck. Try to get out by sea, and you've lost your key of entry to Colombia. To be sure, there are two other seaports: Cartagena, an overnight sail toward the Panama Canal; Buena Ventura, a thousand miles beyond, through the Canal and down the West Coast. They are bottlenecks, too, crowded to the edge of the sea by deserts, mountains and jungle. There are only a few seats on the airplane, which must be booked weeks in advance. That leaves you the Magdalena River. At least, you will be heading for Bogota, the



A small cargo plane delivers mail and merchandise in a few hours. The old river boat took several weeks.

Capital, tightly corked up in its own little bottleneck 800 miles to the north, on a 9,000-foot plateau.

A trip up the Magdalena aboard a Mississippi steamboat built in Pittsburgh is good medicine for the greenhorn. It takes two to three weeks; longer, if you get stuck in the mud. It will unroll a panorama, however, of most of the things—both good and bad—that all South America has to offer. Within a few hours you just slip plumb out of civilization into never-never land. Green, impenetrable jungle walls you in. All day long you are broiled; all night you are steam-cooked. Once a day maybe you run alongside a mud-hut village where you can buy oodles of strange, delicious, tropical fruits for a few cents, with a monkey or a parrot like those you have been seeing in the trees, thrown in for good measure. Now and then a raft of some of the world's most precious woods goes floating by, or a dug-out canoe. At nightfall you get glimpses of faces of untamed naked savages peeping out of the wildwood. Rarely, you steam past a cocoanut grove, a cocoa farm, a banana orchard or a coffee *finka*. Some of them are said to be operated by Americans. For the most part, however, there are only orchids almost within reach in the jungle

Yes, the commuters have their rush hour, too, in Bogota. A San Cristobal trolley poses with its load.

trees, or 14-foot alligators basking in the steaming heat alongshore.

During the first twenty-four hours you passed by Knight's Island of "a million acres found in a Mormon trunk." Like all the rest, it was virgin nature just as God made it. After ten days or [*Continued on page* 81]

# FROM HAWK TO T

by

Major Joseph J. Kruzel, U.S.A.A.F.

*as told to*

Beryl D. Kneen

**Major Kruzel, veteran of the air wars over the Philippines and Java, is now the pilot of a P-47 Thunderbolt. His decorations, the Silver Star and two oak leaf clusters and the Order of the Purple Heart, were won in a Curtiss P-40, the ship he flew and fought in until it was grade B scrap in Java and our flyers had to leave.**

I AM a P-47 pilot graduated to our new top-speed, high altitude fighter by way of air battles in the Philippines, Java and Australia. Out there we flew P-40's, and not a great many of the fighter pilots are left to tell the story of that period. Some who flew P-40's in the Pacific are now flying the P-47. A few will go out to the Pacific again and others will go to Europe. In both war theaters the P-47 has already made its thunderous reputation.

The October, 1943, battle of the Thunderbolts against the Japanese over Wake Island with four P-47 flyers against thirty-two Japanese, which ended with the destruction of eight to ten Japanese and the safe return of all the Thunderbolts, tells its own story. The planes we have today can take big odds and win. We had tough odds against us in the Pacific when I started out against the invading Japanese. But we didn't have enough planes, nor the powerful ones that we have today.

When we pilots who first flew in the Pacific area, using P-40's and other older types, get into a P-47 and feel that speed and climb under our hands ready to use, we go crazy with enthusiasm about our Thunderbolts. We can hardly wait to take them out into the war zone and show what we can do with them.

Why are we so steamed up about the P-47? Because we did so well with the old P-40, in spite of its deficiencies. We can do better with a plane built for modern war. My experience with the "Hawks" began before the war, when I was commissioned and went to the Philippines. Tossed out of there less than a month after the war broke out, we went to Brisbane in B-17's, to get some more P-40's. But by that time the Philippines had been cut off so that fighter planes could not make the long hops through enemy territory to get there. So we went to Java, fought for weeks there, then split up, some going to New Guinea, others to Darwin for eight months of patrol flying.

All of my Jap fighting was done in the P-40. We got a lot of Zeros with it. But air fighting gets tougher and higher, and it is good to know that in the Thunderbolt no one can outshoot or outclimb us. At last we have the stuff—the power, the guns, the speed to get

# THUNDERBOLT

into battle and out again when necessary.

The German FW-190 may be good, but from reports we get on the Thunderbolt, one P-47 pilot can take on three of these new German fighters. We are going to shoot down lots of Nazis—if we can get them to come up and fight.

Much of the story of our brief Philippine campaign has been told by others. But little has been said about the part played by the fighter planes and pilots. Of course, we couldn't stay there long. All the world knows how the Japanese came in on us from Formosa and strafed and burned our fighters on Clark and Iba Fields, while General Brereton was desperately trying to get permission to send out reconnaissance planes to see what the Japs were up to. This was after Pearl Harbor. No one could move until Congress officially voted for war!

We were all on edge waiting for the word to go. We knew the Japs had been flying reconnaissance planes over our fields after dark for some time before the war started.

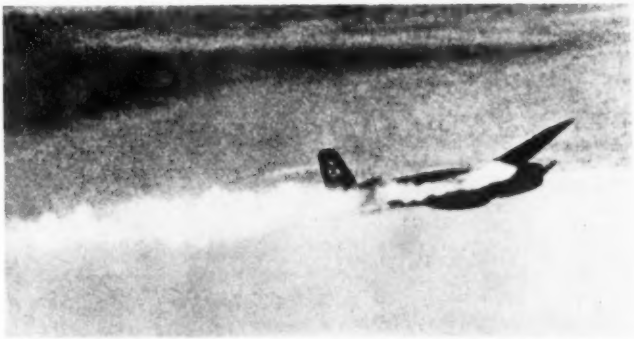
More P-40's than Flying Fortresses escaped the Jap attack, though they came over our fields first, but we didn't have many left. I had about thirty-five combat hours in the Philippines. By that time we had almost nothing left to fly and we were hopelessly outnumbered from the start.

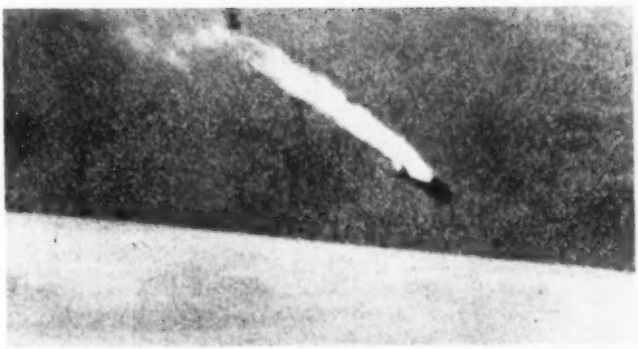
In the Philippines we learned about the Zero the hard way. Probably every pilot who went out and met them came back and cussed and then discussed our poor pre-war information on Japanese planes. We couldn't help but wonder why no one had reported the new Zero that the Japs were flying in huge numbers.

I remember how we rushed to talk with the first of our pilots who encountered the Zero in action. He came back with around forty bullet holes in his plane.

"My God, don't try to dog-fight with 'em," he said. And better advice was never given. We didn't have the speed and climb to do the old world-war type of individual fighting with the Japs.

Those of us who got away from the Philippines, to start the drive back through the Pacific, did learn about air fighting. The first lesson was that the man who comes back is the man who keeps his eyes open all the time.





**There is no greater thrill for a fighter pilot than when he has given an enemy plane a burst, and then sees it go down, streaming smoke and flame. Here's a dead-duck Zero. In the beginning we had too little knowledge of them.**

**"They burned hell out of us before Congress officially voted for war. We lost more bombers than fighters then; but we had few enough left anyway."**

He must have a rubber neck—nothing synthetic about it either.

Buzz Wagner of glorious memory learned a lot of tricks in fighting that helped us all in our tactics. He was out one day loaded with bombs for a field near Lingayen where the Japs were operating. He was picked up by two Jap fighters who came roaring after him smack on his tail. He got them off this vulnerable position by pulling up sharply and letting the Japs tear past him. Then he was on their tails and he shot them down with his .50 caliber guns, the one big advantage that the P-40 had in its fights with the Nips. Keeping his bombs all this time he rendezvoused with Lieutenant Russell Church, and they caught the Japs sitting pretty on the field and strafed them. It gave us some comfort to know that the Americans weren't the only ones caught napping. He got away afterward by a new trick—flying at low altitude and slowly pulling away from two Zeros. But Church made his bomb run with his tail on fire. He did not come back.

This discovery by Buzz, that the P-40 could outrun the Zero at sea level, was valuable information and it saved my life when I was out on a strafing mission over Lingayen Bay. We went out while it was dark and our flight was split up by bad weather. Suddenly the dawn arrived and I found myself out over the beat all alone, looking down on 100 or more transports.

I was carrying six fragmentation bombs and I picked out the biggest transport and climbed up into the clouds to drop my bombs. As I shot down a Zero came toward me flying almost on the water.

I gave it a burst with my guns and came around in a tight left turn. If I hadn't done this automatically, I wouldn't be here today, for as I came around I discovered to my surprise that two Zeros were on my tail—both blazing away with their 20mm. guns. The idea that bullets could be whizzing all around me and that I hadn't even noticed it—gave me a terrible jolt. I came down low and began jinking to get away. But I never forgot that lesson. Now when I go out to fight, no one in the Air Corps looks around more than Joe Kruzel—it pays dividends.

While we were in the Philippines I darn soon learned to take off my cap to the Filipino flyers. The ships they had to fly were hardly first class trainers, chiefly old P-26's with non-retractable landing gear and light .30 caliber guns on them. It was tough that they didn't have better stuff to show what they could do for their home islands. They went out and scrapped and beat it back with their planes full of holes to take off again with a little more gas and ammunition. Captain Jesus Villamar, whom I saw later flying from Australia, used to go out on photographic missions, unarmed and flying an old plane in about the same class as our PT trainers. He was a crack flyer, but it took more than that to photograph Jap activities in such an old, slow and unprotected plane. Six Filipino flyers tackled fifty-four Jap flyers once, brought down two of them and so startled the rest that they turned back for that time.

Well, we did what we could, but finally we were ordered out. The fighter pilots were flown from Bataan in a B-17 leaving on December 31st and January 1st, 1942. We expected to get planes and come back to the Philippines. We found only seventeen planes in all Australia! Even those were not ready for battle. By the time they were in condition the Japanese had cut off the stepping stones back to the Philippines and we could not return. [*Continued on page* 147]

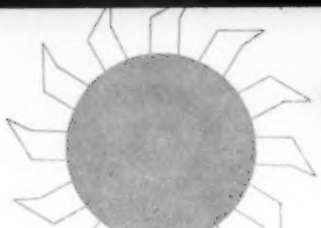
The baler in action, devouring a long line of hay—which is ejected from rear of machine in neat rolls. Technologically, haying was 50 years behind times.

# AUTOMATIC HAY-BALER

TO REVOLUTIONIZE haying, U. F. LEUBBEN of Omaha, Neb., invented a rotary hay baler that makes haying a one-man job with machinery doing the heavy work. His machine scoops hay off the ground, rolls it into a cylindrical bale, ties it and throws it out—all automatically. Big advantage of the round bale, when stacked, is that it leaves spaces through which air can circulate. Older square bales stacked into a solid, air-tight mass. Also round bales limit heating when hay sweats and cut down fire hazard. This baler processes six tons an hour.

Rear view of the machine, showing a completed bale ejected. Older, hand-fed machines packed square bales.

"A thousand golden bales were lying there, shining and still"—at left.



# CYCLES PREDICT

*This is the first of a series of articles by Donald G. Cooley describing the manner in which Science is learning to foretell the future through the study of cycles. Next month Mr. Cooley will tell in further detail how you may learn to plan your own daily life through a knowledge of the earth's rhythms.*

HOW are you going to feel next Tuesday? If you are going to feel elated and sky-high, Tuesday will be no day for you to make investments: the wildest of wildcat projects will look grand to you. But if you will be down in the dumps on Tuesday, it will be a bad day to apply for a job or call on a customer.

Wouldn't it be worth plenty of money to *know* what your emotional ups and downs are going to be? Of course it would! If you know that from Wednesday to Friday next your wife's mood cycle will be scraping bottom, you'll be doubly careful about spilling cigarette ashes and will make a point of complimenting her cooking. If you know your boss will be on top of the world next Monday, you can hit him for a raise and get it.

Well, these emotional ups and downs, of ourselves and of others, *are* predictable. Our moods fluctuate in regular rhythmic patterns. By making a chart of how our moods have shifted in the past, we can get a surprisingly accurate idea of *when* we will feel "up" and when we will feel "down" in days to come.

This is a very minor example of some of the astounding discoveries that are coming out of the infant science of cycle study. A cycle is any phenomenon that recurs periodically. Your hunger cycle is a few hours long; the sunspot cycle is a matter of some 11 years; certain climatic cycles recur at 510-year periods; an ice-age cycle requires tens of thousands of years to repeat.

The tremendously significant fact about cycles is that, having recurred regularly in the past, they will almost surely come again. If you know the length of the cycle, you can calculate very accurately when it will reappear.

In short, *cycles give us a scientific means of predicting the future.*

It is no turbaned, crystal-gazing art of mystery. It is a hard-headed, realistic science rooted firmly in mathematics. So young a science is it that we have no more than traversed its fringes. Its greatest discoveries remain to be made. Their import may well be earth-shaking in significance.

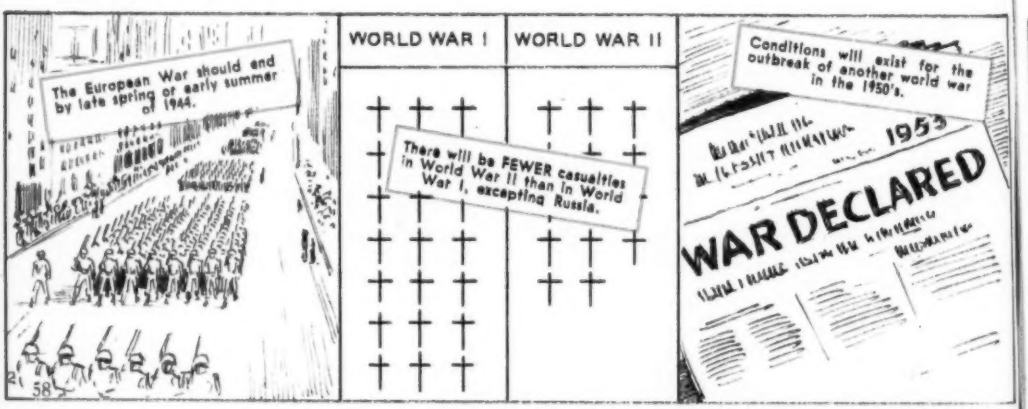
For instance, wouldn't it be worth thousands of precious American lives to know exactly when weather cycles will be ideal for launching an invasion of Europe?

Wouldn't it be worth lives and dollars to know when a new international war might break out, so our fighting forces would be overwhelmingly prepared?

Wouldn't it pay the country to know years in advance when booms and depressions are to be expected?

All of these things appear well within the bounds of *scientific* prediction. Indeed, our military campaigns are even now planned in

CYCLES PREDICT:


The European War should end by late spring of early summer of 1944.
WORLD WAR I
WORLD WAR II
There will be FEWER casualties in World War II than in World War I, excepting Russia.
Conditions will exist for the outbreak of another world war in the 1950's.
1953
WAR DECLARED

# THE FUTURE

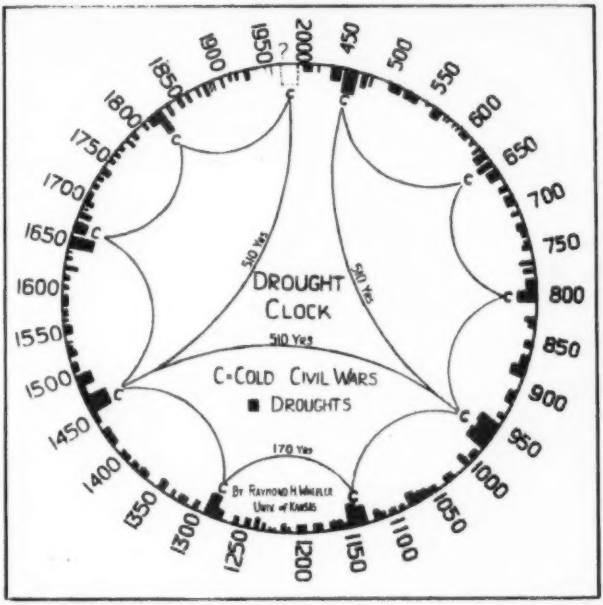
by Donald G. Cooley

close co-operation with weather cycle experts. It was no accident that our North African invasion took place during the one brief period in many months when stormy seas were quiet enough to favor it. The generalship of weather is one of the great untold stories of the war.

Like the pulsations in your own body, the world, the sun, the stars, the universe, throb to countless complex cycles. We are only beginning to measure and identify them. But already scientists are putting cycle knowledge to highly practical use.

In 1935 one big corporation, Westinghouse Electric, studied its own sales records and discovered that the cycle, projected into the future, would show a downward curve in two years. Consequently they did not invest in new plants and, when the anticipated 1937 drop came on schedule, they were not overexpanded and did not have to charge off large sums to interest and obsolescence.

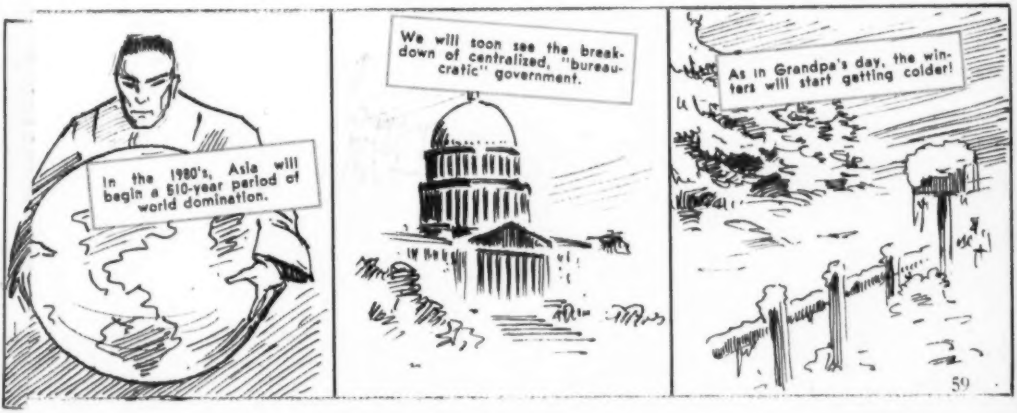
What are some of the things cycles foretell about the future? Let us look at a few of them which have been measured by cycle-scientists:




**The climate of the earth shifts from cold periods to warm periods and back again, in a cycle of about 170 years. At the end of each THREE 170-year cycles (510 years) a major period of cold drought occurs. The "Drought Clock" above, prepared by Dr. Raymond H. Wheeler, shows the 170-year and 510-year cycles from the year 450 A.D. to the present. During each "cold drought" period in the past, there has been a period of civil wars and the breakdown of nations and empires. We are now approaching such a period, due in the 1980's. The earth's climate has been warmer than average for the past 45 years—and is now becoming cold again.**

Your *mood cycle* probably has a four-week swing. That is, you feel grand the first of the month, fall to a "low" two weeks later, then rise to a zestful peak again toward the end of the month. Mood cycles are highly individual, however; learn to recognize your

## CYCLES PREDICT:


In the 1980's, Asia will begin a 510-year period of world domination.
We will soon see the breakdown of centralized, "bureaucratic" government.
As in Grandpa's day, the winters will start getting colder!

own. It may be only a day or two long, or as long as six months or even more. At the bottom of these two pages we print a "score sheet" on which you may keep score on your moods. Keep score for ten weeks and you will know your own "mood pattern."

*Appendicitis,* as Dr. Clarence Mills of the University of Cincinnati has shown, accompanies storm cycles. The disease is much more frequent when the barometer is dropping.

*Baby cycles* charted by Dr. William Petersen of the University of Illinois are about 10 years in length. At the upper peaks of the cycle, babies show greater than average variation in stature. From now until 1948 the cycle is swinging upward; children born during this period will tend to be longer or shorter than would otherwise be the case.

Babies conceived in October, November, and December will tend to be above average in weight, according to a yearly cycle.

*Beef cattle* purchasing power has a 14.8 year cycle, showing a drop around 1945. (Does this indicate a termination of the war by that time?)

*Common stock prices* have a 41-month, and also an 18⅓ year cycle. The chart shows a downward trend through 1944-5, then an upswing through 1946-7.

*Building activity* has a down phase of the cycle until 1946, then up to a peak in 1951.

*Influenza and pneumonia* have a three-year cycle, on the *upcurve* during 1944. Guard against influenza and pneumonia in that period!

A *mouse cycle* in central New York state, measured by Prof. Hamilton of Cornell, is of four-year length. The fewest mice occur (coincidentally) in Presidential election years; i.e., 1944.

*Volcanic activity* has a cycle of some 65 years.

Can all these cycles have any possible relation to each other? They represent but a few of many striking cycles which will be related to our lives in future issues of MECHANIX ILLUSTRATED. But the wide variety of activities indicated raises the question "What causes cycles, anyway?"

No one knows exactly. There are cycles within cycles and it takes great skill to measure any but the simplest and most frequent swings. For hundreds of years, however, the ordinary man has unconsciously recognized the existence of cycles, and acted upon his knowledge.

The phases of the moon and recurrence of tides are ancient knowledge. Cycles have always been prominent in religious ritual. Many very ancient religions observed a season equivalent to Christmas, originating in the fact that this is the period of the winter solstice when the sun "stands still," then swings back in its cycle to bring lifegiving days of greater length and warmth. Easter is closely associated with phases of the moon and the vernal equinox.

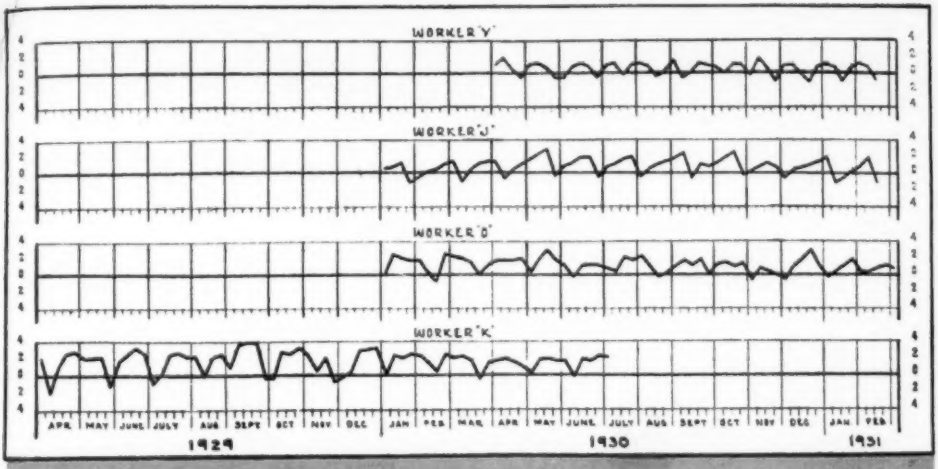
Astrology was doubtless an early effort to predict the future on a basis of stellar and solar cycles. The menstrual cycle, with its peak of tension and irritability, is deeply grounded in common knowledge. The estrous cycle is important to animal breeders.

We recognize cycles in the tender emotions: "In the spring a young man's fancy lightly turns to thoughts of love"; June as a month of brides, etc. The love-life may well be linked to sunlight cycles—photoperiodicity, the scientists unromantically call it. Prof. T. H. Bissonette of Trinity College, Hartford, Conn., is the leading researcher in this field. In experiments with raccoons, he induced the animals to breed a second time in a year by lengthening the light cycle—stretching the length of autumn days by providing artificial light.

Popular recognition comes many croppers,

**Each afternoon, score yourself on the chart below as to how you are feeling. At the end of ten weeks, you will have discovered your own "mood cycle" and will be able to predict how you will feel next Tuesday.**

| | | 1ST. WEEK | | | | | | 2ND. WEEK | | | | | | 3RD. WEEK | | | | | | 4TH. WEEK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | JANUARY | | | | | | JANUARY | | | | | | JANUARY | | | | | | FEBRUARY | | | | | |
| | | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 29 | 30 | 1 | 2 | 3 | 4 | 5 | |
| | | T | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | |
| +4 | BEST | | | | | | | | | | | | | | | | | | | | | | | | |
| +3 | VERY GOOD | | | | | | | | | | | | | | | | | | | | | | | | |
| +2 | GOOD | | | | | | | | | | | | | | | | | | | | | | | | |
| +1 | FAIR | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | NEUTRAL | | | | | | | | | | | | | | | | | | | | | | | | |
| -1 | INDIFFERENT | | | | | | | | | | | | | | | | | | | | | | | | |
| -2 | WORRIED | | | | | | | | | | | | | | | | | | | | | | | | |
| -3 | POOR | | | | | | | | | | | | | | | | | | | | | | | | |
| -4 | TERRIBLE | | | | | | | | | | | | | | | | | | | | | | | | |


WORKER 'Y'
WORKER 'J'
WORKER 'D'
WORKER 'K'
APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB.
1929
1930
1931

**Professor Rexford B. Hersey, University of Pennsylvania, checked the "mood" of individual workers in a plant over a period of weeks and discovered each worker had a "pattern." Above are the "up and down mood" graphs of four workers. If you will use the chart below, you may discover your own "mood pattern."**

however, when it attempts to interpret cycles without scientific aid. Commonly, the fact that two unrelated cycles have the same length leads to false identification. Thus we have such errors as identifying the lunar with the menstrual cycle, or attributing lunacy (many mental disorders are highly cyclic) to phases of the moon.

Scores of researchers are now bringing order to the new science of cycles—so many, in fact, that a Foundation for the Study of Cycles, directed by Edward Russell Dewey, has been established to co-ordinate their findings. Thirty-four scientific societies, covering such fields as agriculture, medicine, biology, psychology, physics, zoology, meteorology, seismology, etc., are co-operating.

The immense practical value of such research hardly requires pointing out. Long range weather forecasts would enable farmers to plan their crops years in advance, be prepared for droughts or sudden frosts. Shorter weather cycles are important in aviation. Doctors could be prepared to diagnose and treat epidemics destined to occur. Wholesale price cycles would tell business men when to stock their warehouses, when to go easy lest they be squeezed by falling prices.

The truth is that any science, to merit the name, *must be able to predict accurately*. Arithmetic predicts that 2 plus 2 will give 4. Chemistry predicts that sodium united with chlorine will give common salt. Physics predicts that a light wave of specified length will look red. By this test, the study of cycles is the very essence of science, giving us the power to predict accurately over an infinitely wide range of activities.

Out at the University of Kansas, Dr. Raymond H. Wheeler, with a large staff of assistants, has spent twelve years compiling one of the most comprehensive cycle studies in

| 5TH. WEEK | | | | | | 6TH. WEEK | | | | | | 7TH. WEEK | | | | | | 8TH. WEEK | | | | | | 9TH. WEEK | | | | | | 10TH. WEEK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FEBRUARY | | | | | | FEBRUARY | | | | | | FEBRUARY | | | | | | MARCH | | | | | | MARCH | | | | | | MARCH | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 20 |
| M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. | M. | T. | W. | T. | F. | S. |

existence. Thousands of observations on the ups and downs in human affairs over a period of 1,600 years have been carefully entered on elaborate charts and their rhythms noted.

If the cycles noted by Dr. Wheeler are accurate, the things they have to tell us about our own futures are staggering. And they *have* been accurate for 16 centuries! The future course of government, war, religion, population, art, design, politics, population, economics, climate—all are foreshadowed by cycles which have recurred with clocklike regularity since 400 A. D.

Dr. Wheeler started out to trace the history of his specialty, psychology. Beginning with ancient Greece, he found that over the centuries there was a definite rhythm—a pendulum-like swing between romanticism and mechanism in art, music, literature, biology, chemistry, and other cultural expressions. Battles of history (17,000 were charted) showed similar rhythms: a period of international wars would give way to a cycle of civil wars. Unexpectedly, the war and culture cycles coincided. International wars occurred mainly in the *romantic* or *idealistic* cycle, civil wars during the *mechanistic* periods.

It seemed, indeed, that cycles had something to say about the future! But more impressive proof was yet to come. Dr. A. E. Douglass of the University of Arizona is famous for his tree-ring studies. By measuring the width of the annual rings left in tree trunks by seasonal growth, he has been able to reconstruct climatic conditions for hundreds of years back. Thick rings indicate plenty of moisture for growth; thin rings, period of drought. Dr. Douglass charted the rings of hundreds of ancient trees and constructed a table of *climate cycles* from this evidence.

Now comes the dramatic marriage of cycles. By accident, through mention by a friend, Dr. Douglass's cycle charts were called to Dr. Wheeler's attention. The latter secured a copy of them, placed the climate charts over his own charts of war and culture, and found that they fitted beautifully! The evidence was strongly suggestive that fluctuations in human behavior, as expressed in wars and cultures, is conditioned by climate.

Next, Dr. Wheeler charted the ups and downs of these cycles on a circle, a great clock face representing 1,600 years of time. It became all the more evident that certain cycles did indeed recur as regularly as clockwork. Sometimes the "clock" was a few seconds slow, sometimes a little fast, but the variation was slight.

Now, reading what the cycle clock had ticked off so accurately for the past 1,550 years, it was easy to get a scientific forecast of what the next 50 or 100 years will hold.

One indication of the clock is that the war in Europe may well terminate by late spring or early summer of 1944.

Another indication is that, in the 1950's, conditions will favor another great international war, the year 1952 being an especial period of danger.

The world faces a period of civil wars, uprisings, rebellions and more or less chaotic conditions until the year 1980. After that a new cultural era should begin, a great renaissance, a new "golden age," so that our descendants by the year 2,000 should be living in a democratic world state or federation, an ideal that at this moment seems hopelessly remote.

How does the cycle clock reveal such a story?

Very briefly, the clock shows the climate of the earth swinging from warmer to colder periods, and back again, in a 170-year cycle (including several minor cycles). At each third swing of the cycle—that is, every 510-years—the rhythms coincide and there is intensification of the effects.

When the cycle shifts from cold to warm, human energy is high; nations are built. When it shifts from warm to cold, nations crumble. International wars throughout history have occurred mostly during warm periods, civil wars during cold.

Now, in 1944, we are near the beginning of a cold period since it has been generally warm for about 45 years. Totalitarianism and dictators are typical of late-half warm periods (as, in actual fact, has been true of the past 25 years). But when, as at present, the world moves into a cold period, democracy revives and dictators topple. The doom of Hitler and Tojo is written in the cycles!

Around 1950, one of the cycles within cycles operates to favor a temporary warm period. This swing indicates a period of danger of new international wars, the peak coming around 1952. But the over-all cold cycle quickly comes back and the general trend toward democracy and a new golden age is most pronounced beginning with 1980. At this time the 170-year, the 510-year, and a longer 1,000 year climate cycle coincide to magnify their effects.

In the transition period from warm to cold, which we are now in, certain trends vital to all of us are forecast by the cycles. Whether you are a business man, a student, a wife and mother—whatever your status—it is easy to see how these trends will affect your manner of living:

*Government:* Decentralization of government powers, reductions in bureaucracy, destruction of Gestapo-like police systems, overthrow of dictators, reaction against socialism, revival of individuality and capitalism, but more humanized than before, emergence of local bosses.

*Family:* Increase in birth rate, stricter sexual behavior (Puritanism).

*Business:* Cut-throat competition, minimum of government interference, many strikes and labor troubles, increase in free trade.

*Religion:* Religious revival, return of simple faith and religion as personal experience, rise of evangelism, appearance of many new small sects, tolerance of state toward church, great upsurge in missionary work.

*Education:* Return of discipline in the schools and emphasis on the three R's, educational systems more universal, return of emphasis on science and mathematics as opposed to the social sciences.

[*Continued on page* 144]

# BEGINNING

## THE 4TH ANNUAL MECHANIX ILLUSTRATED

# WORD GAME CONTEST!

MORE THAN

## $5,000 IN WAR BONDS

### 100 PRIZES IN WAR BONDS AND STAMPS!

| | | | | | |
|---|---|---|---|---|---|
| 1st | PRIZE | $1,500 | In | War | Bonds |
| 2nd | " | $1,000 | " | " | " |
| 3rd | " | $ 750 | " | " | " |
| 4th | " | $ 500 | " | " | " |
| 5th | " | $ 250 | " | " | " |
| 6th | " | $ 175 | " | " | " |
| 7th | " | $ 125 | " | " | " |
| 8th | " | $ 100 | " | " | " |
| 9th | " | $ 75 | " | " | " |
| 10th | " | $ 50 | " | " | " |
| 11th-25th | " | $ 25 | " | " | " |

75 PRIZES, 26th to 100th $5.00 IN WAR SAVINGS STAMPS

CONTEST FANS! Here we go again! MECHANIX ILLUSTRATED has become famous for its annual Word Game Contests. Starting this month, we're having another Build-Words game—more fun than a crossword puzzle, more intriguing than acrostics. It's a contest in which skill alone wins—no "25 words" slogans. And look at those prizes! One hundred of them—all in War Bonds and War Savings Stamps. Turn the page and start right now!

BUY MORE WAR BONDS

# Here Is The First Puzzle

## CONTEST RULES

1. A different "BUILDWORDS" puzzle will appear in each of the February, March and April issues of MECHANIX ILLUSTRATED. The first puzzle appears on the opposite page. Contestants will complete each of the three puzzles, striving to attain the highest score possible and printing the score in the proper place marked "TOTAL" on each of the entry blanks, together with the name and address of the contestant. The third entry blank will contain a space marked "GRAND TOTAL" in which the contestant will print the total accumulated in all three puzzles.

2. The individual having the largest correct grand total as printed in the third entry blank will win first prize. The individual having the second largest grand total will win second prize, etc. In the event of a tie for any prize, the individual turning in the neatest, most original and most legible entry will be awarded the higher prize, with the next prize going to the tying entry. However, "fancy" entries will in no case be given preference.

3. Do not send in entry blanks separately. Save your February and March puzzles until you have completed your April puzzle and send in all three blanks together by first class mail, addressing them to "BUILDWORDS EDITOR," MECHANIX ILLUSTRATED, 1501 Broadway, New York (18), N. Y.

4. Contestants may submit legible copies of the first two entry blanks as their official entry if they so desire. The third entry blank must be the one clipped from the April, 1943, issue of MECHANIX ILLUSTRATED.

5. Webster's New International Dictionary, Second Edition, will be considered final authority on acceptance of words used in the puzzles. Words appearing anywhere in this dictionary, as well as forms of those words in accepted usage as constructed under dictionary rules, will be permissible. However, hyphenated words and possessives formed with an apostrophe are not acceptable. Proper nouns and regular plurals, under dictionary definitions, as well as irregular plurals found in the dictionary, are acceptable.

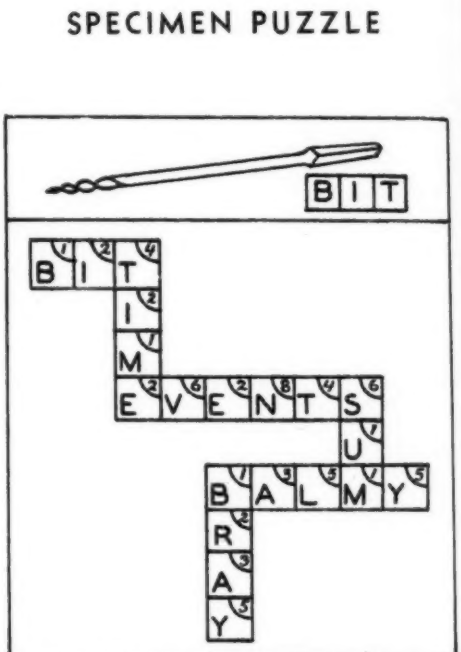
6. No entries will be returned and under no circumstances can we enter into correspondence regarding this contest. Judges will be the Editors of MECHANIX ILLUSTRATED. Their decisions will be final. Anyone in the United States or Canada may compete except employees of Fawcett Publications or members of their families.

7. No contestant may win more than one prize. Neatness, originality and legibility will be considered in judging all entries.

8. This contest closes April 15, 1944. Entries postmarked in the mail later than midnight on that date will not be considered.

9. Prizes in this contest shall be as set forth on the preceding page.

## SPECIMEN PUZZLE




LETTER VALUE CHART

| | | | |
|---|---|---|---|
| A — 3 | G — 4 | M — 1 | T — 4 |
| B — 1 | H — 6 | N — 8 | U — 1 |
| C — 8 | I — 2 | O — 3 | V — 6 |
| D — 5 | J — 7 | P — 2 | W — 7 |
| E — 2 | K — 1 | Q — 4 | X — 2 |
| F — 7 | L — 5 | R — 2 | Y — 5 |
| | | S — 6 | Z — 3 |

MY HIGH SCORE IS 64

# In The MI PRIZE CONTEST

## HOW TO DO "BUILDWORDS"

"BUILDWORDS" is as easy as rolling off a log. Just look at the specimen "BUILDWORDS" on the opposite page. It has been filled out for your guidance.

FIRST: You will notice that the first thing we did on the specimen puzzle was to identify the tool shown in the picture at the top. It's a BIT, of course.

SECOND: We found a three-letter space among the squares below. You will note we put the word in the top three squares. We might just as well have put it in the other three-letter square group where you now find the word SUM. Puzzle No. 1 has a five-letter key word.

THIRD: Fill in the other rows of interlocking squares, using the "T" in BIT as a jumping off place. Use only accepted dictionary words, as explained in the rules. Each letter has a different numerical value, given in the chart below the specimen puzzle. The letters "C" and "N" have the highest value, as you will note, so you obviously should try to get in as many words with "Cs" and "Ns" in them as possible, to bring up your score. Place the numerical value of each letter in the corner of the square. All words must read from top to bottom or from left to right.

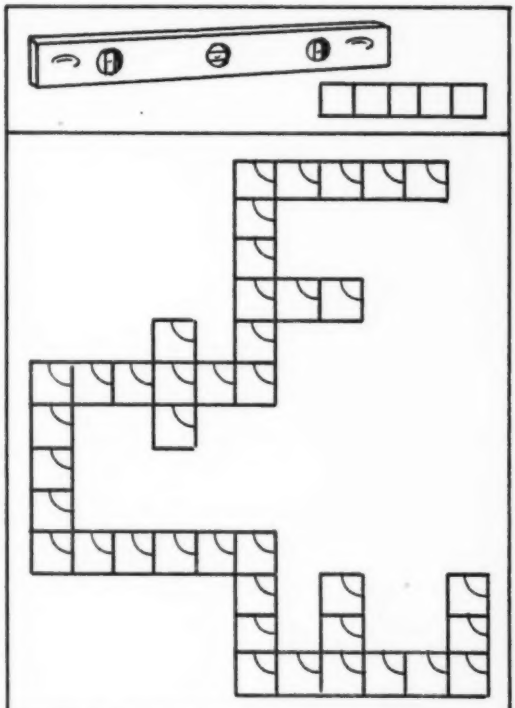
FOURTH: After you have fitted words into all of the interlocking squares, as demonstrated in the specimen, add together the values of all the letters and print your total score in the space provided for it at the bottom.

FINALLY: READ THE RULES CAREFULLY AND FOLLOW THEM PRECISELY!

### CONTESTANTS

Would you like to have a chance to win a cash prize, as well as one of the regular contest prizes, shown on page 63? If you would, turn to page 142 and see how you can win a Cash Sponsorship prize, merely by telling your friends about MECHANIX ILLUSTRATED'S great "Buildwords" contest!

## PUZZLE NO. 1



### LETTER VALUE CHART

| | | | |
|---|---|---|---|
| A — 3 | G — 4 | M — 1 | T — 4 |
| B — 1 | H — 6 | N — 8 | U — 1 |
| C — 8 | I — 2 | O — 3 | V — 6 |
| D — 5 | J — 7 | P — 2 | W — 7 |
| E — 2 | K — 1 | Q — 4 | X — 2 |
| F — 7 | L — 5 | R — 2 | Y — 5 |
| | | S — 6 | Z — 3 |

MY HIGH SCORE IS ____

NAME .....

ADDRESS .....

CITY..... STATE.....

If you were sponsored in this contest fill out the following. If not, leave these spaces blank.

SPONSOR'S NAME.....

ADDRESS .....

CITY..... STATE.....

Save this puzzle and Puzzle No. 2, appearing in the March issue of MECHANIX ILLUSTRATED, until you have Completed Puzzle No. 3 appearing in the April issue of MECHANIX ILLUSTRATED. Send all three completed puzzles in together.

# LIGHT FOR THE FUTURE

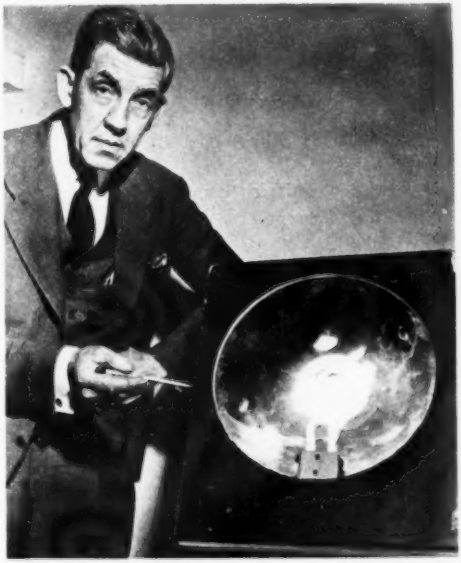
Electronically bombarded by a beam of high frequency radio energy, this glass ball becomes alive with light. Inside of the globe is coated with phosphors, as in the common fluorescent lamps.

**Wires? They always were a nuisance. Now you can carry your lamps with you without wires or set them up in the path of shortwave energy, the kind produced by a pre-war diathermy machine.**

SAMUEL HIBBEN, director of applied lighting for the Westinghouse lamp division, demonstrates probable uses of war-time light in the future. From wireless lamps (graceful shapes of multi-colored light that should make current theatrical producers despair) to a quartz, mercury vapor light that can give us a white sun at midnight, is the range. Post-war household uses run from home sterilization and comfort heating to cooking with light. The use of phosphors alone, in lamps, will open a new world to architects.

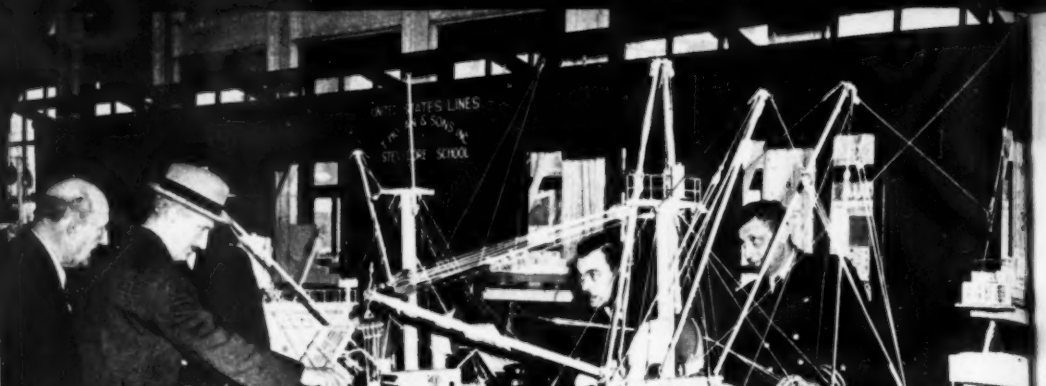
Here are eggs and bacon being cooked to taste on the upturned lens of a seal-beam lamp from an Army bomber. Redesigned, such radiant heat devices may be used for "comfort heating" in the new home.

Out of cold water this lamp would burn out in a few seconds. Westinghouse engineers designed it for the practical and romantic occupation of deep-sea diving. It lights up, withstands the pressure of the ocean floor.



This coiled, quartz tube, mercury vapor lamp transmutes oxygen in the air into ozone by ultra-violet radiations. Post-war uses? Keeping eggs fresh, bleaching—quick testing for color fastness of dyes.

The Frankenstein of light? A 10,000-watt mercury vapor lamp with the brilliance of one-fifth of that on the surface of the sun. The quartz tube must be cooled by a flow of cold water. Note cigarette lighting.



**The loading of ships sailing to our armed forces and allies requires swift and careful measuring so that time is saved and all available space is used. Clerks of the Army Transport Service wrote Mr. Andrews, stating a problem and hoping that dozenal arithmetic might help them solve it easily. It worked out to be true.**

# FURTHER ADVENTURE IN COUNTING

by F. Emerson Andrews, Author of "New Numbers"

LAST September in MECHANIX ILLUSTRATED I tried to point out that our present method of counting—by tens—is merely a heritage from the primitive past when people had not yet invented number-signs and therefore used their fingers for tallies. When numerals were invented, we just kept on counting by tens (except for a few peoples in warm climates who also used their toes, and therefore counted by twenties) from sheer habit, even though counting by tens did not fit in at all well with many natural and arithmetical laws, and has made arithmetic as we now use it a much more cumbersome process than it need be.

I suggested the adventure of actually doing some counting and some simple problems with a new and better number system—a system mathematicians have long known in theory, but seldom tried out. Immediately the editors and I began receiving letters from readers deeply interested in this new way of counting, and wishing further information.

One letter, especially, commanded prompt attention:

As spokesman for a group of clerks employed by the Army Transport Service, engaged in measuring cargo loaded aboard ships sailing to our armed forces and allies, we are greatly interested in your article . . . If you can straighten us out with a few demonstrations, it would add greatly to the speed and efficiency of our work.

These clerks then described a typical problem, getting the cubic content of a package measuring 2′ 6″ x 3′ 6″ x 4′ 2″. We may as well take this actual problem, see why our present arithmetic fails, what can we do.

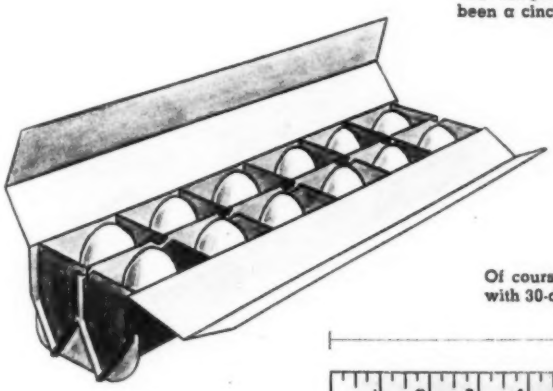
It ought to be perfectly simple to multiply these three numbers together and get cubic measure, but, as we all know, it is actually quite a lengthy process. We cannot multiply mixed numbers containing both feet and inches. Moreover, inches cannot be expressed satisfactorily as decimals of feet since there are twelve inches to the foot and we count by tens; that 2″ item would never come out, but be .16666. . . . If we convert everything to inches, we get quite large numbers and in the end we have to divide by 1728 to find the cubic feet. The Transport clerks, as a matter of fact, do have a system of cross-multiplication which helps somewhat, but even it is complicated and invites errors.

Clearly, the crux of our difficulty is that our system of measure—12 units to the next larger unit—and our system of counting—10 units to the next larger unit—do not jibe. This is not only true of feet and inches; we have 12 hours to the half day, 12 months to the year, 30 dozen degrees to the circle, eggs and most packaged objects by the dozen and the dozen-dozen, or gross. We might try to get these gears meshing instead of clashing by changing all our units to the ten base, as the French metric system does with many of them. But with ten inches to the foot, you cannot have convenient thirds or even quarters, the circle does not lend itself conveniently to ten, and inexorable laws of geometry make tens awkward to handle in packaging, while the dozen, divisible by 2, 3, 4, and 6, is ideal. Moreover, those cargoes for our armies in Italy are waiting to be loaded, and the packing cases *are* measured in feet and inches.

COMPLETE MULTIPLICATION TABLE, BASE OF 12

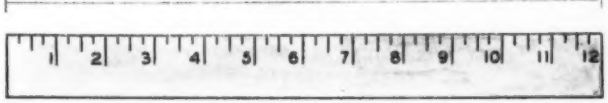
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | X | Ɛ | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | X | 10 | 12 | 14 | 16 | 18 | 1X | 20 |
| 3 | 6 | 9 | 10 | 13 | 16 | 19 | 20 | 23 | 26 | 29 | 30 |
| 4 | 8 | 10 | 14 | 18 | 20 | 24 | 28 | 30 | 34 | 38 | 40 |
| 5 | X | 13 | 18 | 21 | 26 | 2Ɛ | 34 | 39 | 42 | 47 | 50 |
| 6 | 10 | 16 | 20 | 26 | 30 | 36 | 40 | 46 | 50 | 56 | 60 |
| 7 | 12 | 19 | 24 | 2Ɛ | 36 | 41 | 48 | 53 | 5X | 65 | 70 |
| 8 | 14 | 20 | 28 | 34 | 40 | 48 | 54 | 60 | 68 | 74 | 80 |
| 9 | 16 | 23 | 30 | 39 | 46 | 53 | 60 | 69 | 76 | 83 | 90 |
| X | 18 | 26 | 34 | 42 | 50 | 5X | 68 | 76 | 84 | 92 | X0 |
| Ɛ | 1X | 29 | 38 | 47 | 56 | 65 | 74 | 83 | 92 | X1 | Ɛ0 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | X0 | Ɛ0 | 100 |

**The complete dozenal multiplication table would have been a cinch for us all, alas, had we started with it first.**



**Think of eggs and most other packaged articles. It's a rare grocer indeed who sells his oranges by tens or twenties.**

**Of course there are twelve inches to the foot. Go on with 30-dozen degrees in a circle, 12 months a year, etc.**



So—instead of changing the highly convenient 12 units of our measuring system into the arbitrary 10 units of our numerals, why not invent two more *numerals* so as to have 12 units in both?

Let us use the Roman *X*, and call it *dec*, to represent ten; and let us use *E*, and call it *el*, to represent eleven. After *el* we start the second column of numerals, just as we used to start it after 9. But now *10* means one dozen and no units, instead of one ten and no units, so we shall call it *do* for dozen. We count:

| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* |
|---|---|---|---|---|---|---|---|---|
| *One* | *two* | *three* | *four* | *five* | *six* | *seven* | *eight* | *nine* |
| | | | *X* | *E* | *10* | | | |
| | | | *dec* | *el* | *do* | | | |

From this point on, numerals in *italics* are to be understood as *dozenal* numbers. Therefore, such a number as *42* has a meaning similar to 4′ 2″, which is not 42 inches but 4 dozen and 2 inches, actually 50 inches. And a number like *265* no longer means 5 units plus 6 tens plus 2 tens-of-tens; it means 5 units plus *6* dozens plus *2* dozen-dozen, which happens to be the quantity we normally express as 365. So, in dozenal numbers, there are *265* days (*two-gro six-do five* days) in the normal year.

Any problem that can be done by ordinary 10-base arithmetic can be done by dozenal arithmetic, and usually more efficiently. The reasons for that greater efficiency were explained in the September issue; now we are interested in getting on with loading that ship, in *how* rather than *why*. Grab a pencil and the back of an envelope and join us; you need no more mathematical ability than is involved in simple addition, subtraction, multiplication, and division.

II

Let's try a few simple additions, remembering that we add up to a dozen before carrying one:

| | | | |
|---|---|---|---|
| *54* | *136* | Five ft. nine in. | *5.9* |
| *31* | *694* | Three ft. two in. | *3.2* |
| *96* | *3E2* | Two ft. eight in. | *2.8* |
| *15E* | *1000* | Eleven ft. seven in. | *E.7* |

Observe that in problems involving feet and inches, dozens, and the like, the dozenal numbers permit handling dozens and units without converting either; 5.9 actually means 5 and 9/12 feet. The answer is brief and very clear—*E.7* is 11 feet 7 inches.

Now, for your own practice, let's take a certain rather amusing number, and keep adding it to its own totals:

| | | |
|---|---|---|
| *186X35* | *35186X* | *5186X3* |
| *186X35* | *186X35* | *186X35* |
| *35186X* | *5186X3* | *6X3518* |

What have we here? We keep adding a number to its own successive totals, and each time come out with the very same six digits, and in the same general order but beginning at a different place in the series. Take your scratch pad and add it several more times; on the lucky seventh, if you did your addition correctly, you will get a surprise.

Is there something wrong with dozenal counting that a number could behave in this unreasonable way? No; a whole series of such peculiar numbers is available in any number system. Try 142857 by ordinary 10-system addition, and you will get a similar result. These revolving numbers (circulatory numbers, periodic fractions) have many amusing properties; for instance, the latter half of each such number bears a complementary relation to the first half; i.e., it is the difference between the first half and *EEE* . . . (or 999 . . .).

Subtraction is simply the reverse of addition; it is only necessary to remember that when you borrow, you get a dozen more units instead of ten. For example: Sadie has a strip of hall carpeting 8 feet 7 inches long (*8.7′*); her new hall is 11 feet 2 inches long (*E.2′*). How much additional carpeting does she need?

*E.2*
*8.7*
*2.7* Two feet, seven inches

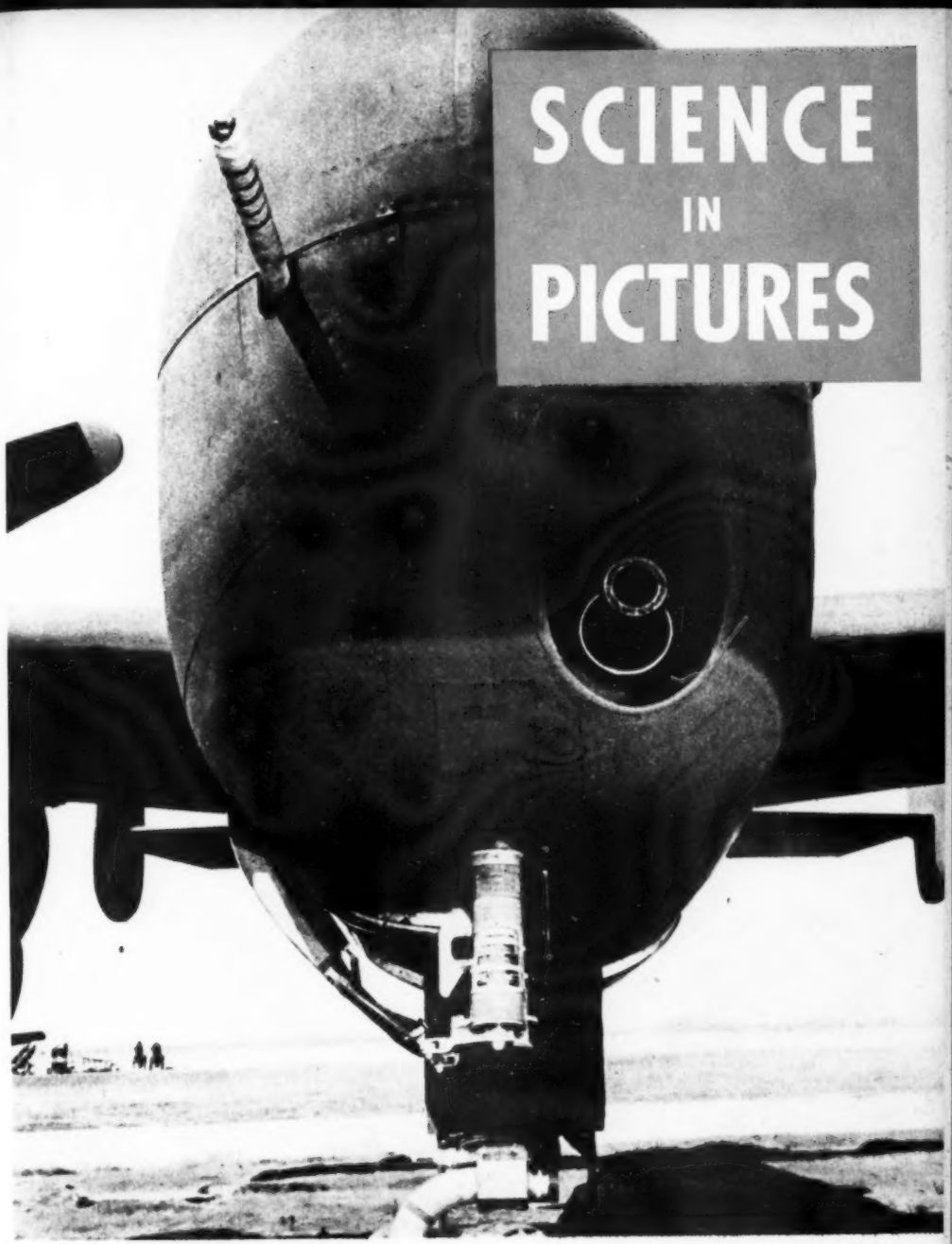
Some practice at this point is desirable, and here is a trick number which will enable you to prove your own answers:

*0478X X0935 98166 E7431 1E286 23X55*

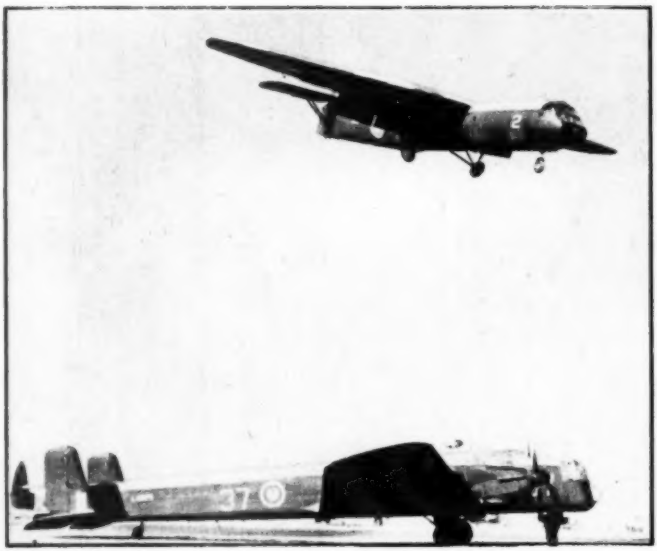
This is another of the "revolving" numbers. Set it down on your scratch pad in its largest terms, beginning with *E74* . . . and then set the above number below it, and subtract. If your work is correct, you will come out with the same digits in the same order but beginning with *E28*. . . . You can always prove your answer, and correct your own mistakes, by referring to the original number, and you can keep on subtracting the original number from your new totals up to the thirtieth time, when you will work back to all zeros. This is self-proving arithmetic with a vengeance!

[*Continued on page* 150]

# SCIENCE IN PICTURES



OUR Mitchell bomber's Sunday punch. A 75mm. cannon pokes out its heavy barrel from the all-metal nose of the new B-25, our famous medium bomber. As a ground attack weapon, as a tank buster, a cannon of this size should come upon no prey too heavily armored for it. The big problem in mounting such guns on aircraft was recoil. The Army is saying nothing about that important mechanism of this gun. The new planes have already sunk ships in the South Pacific, seen action in the Mediterranean.



## O, He Floats Through The Air—

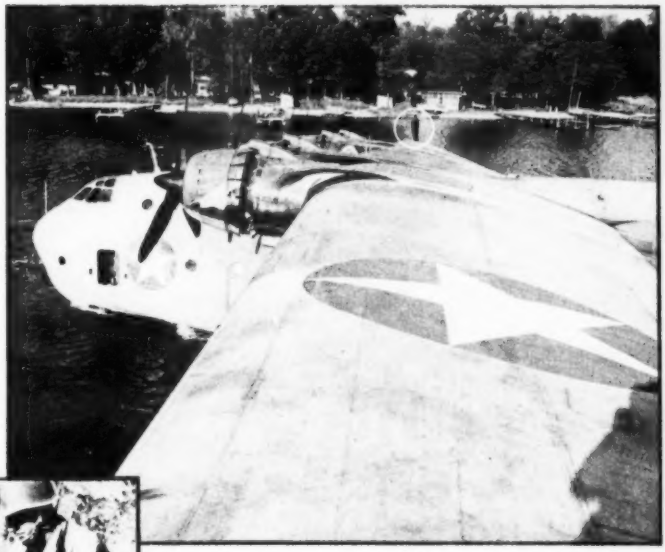
THE none too handsome but efficient Horsa glider, built to carry a load of twenty-eight fully equipped soldiers, comes in for a landing with its flaps down at a glider training base in England. Beneath it on the runway rests a huge, dragon fly-like tow plane, the Whitley tug plane, designed to haul gliders into the air to their destinations. A large number of carefully selected pupils are sent to this glider conversion unit for their specialized training. These two airships are 100 per cent functional.

## New Hampshire Gets The Wood Out

BECAUSE of a swamp and peat bogs, a team of horses or a truck can't get out the valuable pine, fir and spruce from a New Hampshire woodlot. Owner of the land, 78-year-old Elbert Smith, built himself a 739-foot logging railroad to solve the problem. The tracks are made of wood, but the car rides on roller-bearing wheels bought in a machine shop. An old winch provides locomotion, Mr. Smith the manpower.

## Our Flying Boardwalk

YOU wouldn't think so—but that Chief Petty Officer in the circle on the far wing tip of this flying boat weighs 200-pounds. This is the Martin PB2M-I Mars, naval counterpart of the Army's Douglas B-19—and the largest flying boat in the world. Weight 62.7-tons, wing span 200 feet. It has a crew of eleven and can carry 150 fully armed troops. The Mars can fly to Europe and return.



## Bring 'Em Back For The "Fourth," Boys

YANKS are familiar with rockets from childhood, but these three American soldiers (left) take time out to examine a German product that has a new twist. This projectile, known as the 32 cm. incendiary rocket, is fired directly from crate in which it's shipped. Here it's in firing position.

## It'll Give You The Jeeps

WE'VE all seen 'em in rivers, pulling trains, climbing trees, delivering generals and made up as beds; but this is the first time a Jeep family (right) has posed for its picture. Frank Tillotson built the pint-sized one for his boy, Ken, powered it with a refrigerator motor.

## Private And Public 'Copters

HELICOPTER designers are covering the transportation field from every angle. Above is a model of a fourteen-passenger air bus used by Greyhound Bus Lines to convince the Civil Aeronautics Board that it should be granted permission to use air buses in local air service over 49,130 miles of routes. Raymond Loewy designed the cloud-bound bus in collaboration with Igor Sikorsky. At the right is a plywood 'copter designed for private use. This one has twin sixteen-foot rotors and a vertical stabilizer instead of an aft rotor. Fred Landgraf, Los Angeles engineer, built this one. The tear drop design helps greatly in dispelling the clumsy, home-built look so common to many of these machines.

## Now Tanks Have An Ambulance

THE Tank Recovery Vehicle, our War Department's M-25, waits for a tank to amble onto its huge chassis. Weighing over forty tons, this armored monster carries tanks to front lines and hauls disabled ones from battlefields for repairs. The M-25 makes it possible for tanks to enter battle with full fuel loads and cool motors, an invaluable assist. It can operate for four days on its own. It is also a "mother ship" to light, motorized equipment that has broken down.

# PLASTICS

## THE GREAT *New* FIELD OF OPPORTUNITY

### PLASTICS ENGINEERS AND TECHNICIANS NEEDED IN NOT ONE BUT MANY CLASSES OF INDUSTRY

● Leaders in science and industry have long been saying, "Keep your eye on Plastics." But now the time for action has arrived. The future of huge possibilities has already begun. Developments in Plastics for hundreds of wartime uses have set the pace for revolutionary changes in peacetime production of thousands of products.

**THIS IS YOUR BIG CHANCE**

Today there's a big need in vital war production for those who are trained in Plastics. From one to a hundred articles made of Plastics must be supplied for every man in our fighting forces. Start training now in Plastics Engineering, in spare time in your own home. Fit yourself for a responsible, well-paid position. Help to win Victory. And at the same time you will be preparing for even greater opportunities when the war is over.

There is scarcely an industry in which these so-called "miracle materials" will not play an important part. After the war many old materials, methods and skills will be replaced. Acquire the all-important "know how." Be in a position to step into one of the key jobs.

**YOU CAN LEARN WHILE YOU EARN**

Turn at least part of your leisure time into money. Qualify at home for a larger income in an interesting career. Build greater security for your future in a vocation that looms large on the horizon of the new industrial era. Hours you might otherwise waste can put you well on your way toward lasting success.

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## How They Let Them Go

TWO members of our Twelfth Air Force Service Command study the new electric-type wing bomb release mechanism of a German Messerschmitt 110 fighter-bomber, another plane captured intact.

## A Jewel Of A Dragon Fly

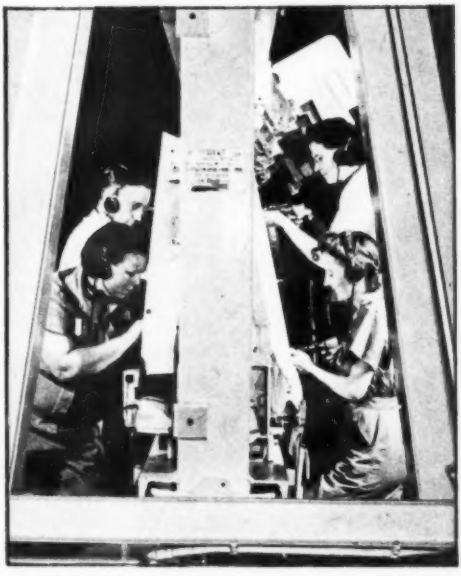
TINY aircraft instrument jewels that weigh but 2/1000ths of a gram make a glistening necklace for a dragon fly (upper right). These jewels of pin-head size, made by General Electric, are so small that it would take 1,650,000 of them to fill a gallon jug. If they sold by the pound, price would be $21,000. Made somewhat in the design of a lifesaver, each one is 6/100ths of an inch in diameter.

## Family Amphib.

YOU can pile out of your house with your family and your fishing pole, drive down to the shore and keep right on going—out to sea—in this amphibian. C. L. Hibert, San Diego, Cal., built his land-going boat along Catalina flying boat bottom lines. Retractable airplane wheels enable him to launch it directly from trailer to surf. Wheels are mounted on steel arms fastened to an axle running through hull. Water lifts them up out of the way, a chain then pulls gear past vertical position, where it rests on chocks. Too bad it can't fly.

# NUMBER, PLEASE

THE war effort's three great words—speed, accuracy, production—have found their way into the odd communications field. Above is Col. Frank Kennedy's radio system for dispatching trains at Spokane Air Depot railroad yard. Here the Colonel takes a routing call from dispatcher's office. (Girl at right.) Below left, the shortest direct telephone line—for aircraft riveters—so that riveter and bucker can communicate above noise and without changing working positions. Below right, electronic interphones speed up production and prevent costly errors in aircraft and shipbuilding. They have outmoded visual signal communication methods, are featherweight portables.



## One Man Hay Stacker

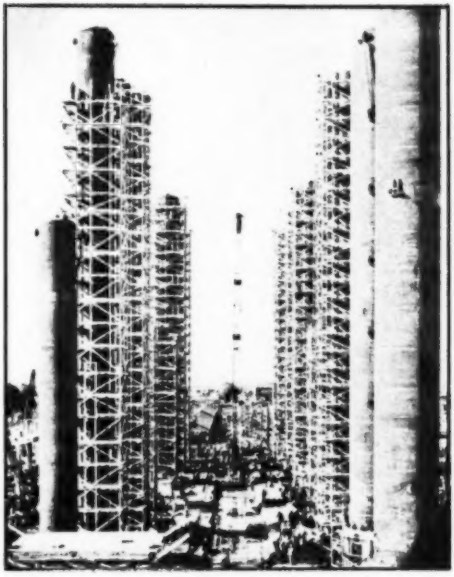
ROY MARSHAL, West Plains, Mo., had many acres in meadow and only his own manpower to harvest and stack the hay. He solved the stacking problem by building this contraption made out of cast-off parts of worn-out farm machinery. The upright, forked at the top, swings around on a pivot at its bottom. The long sweep, supported by the crotch, has the old oaken bucket lifting principle. A horse-powered windlass raises the load impaled on the fork attached to upper end of sweep. Then a push of the hand swings the hay around to where it is wanted.

## Won't Willie Want One!

ONE airborne trooper starts off wobbly-legged while his buddy unfolds his own motor scooter, dropped by parachute. Note the coffin-like scooter case. These little machines can race along up to 45 m.p.h., can go 180 miles on a gallon of gas. Hey! Soldier, bank around that flat rock booby trap!

## Tall Texas Tale

UP GOES one-seventh of our wartime rubber needs in Port Neches, Texas. Great columns, tall as a 17-story building, are fabricated on the ground and hoisted into position by the world's largest crane. This plant will turn out 100,000 tons of butadiene a year, chief ingredient of synthetic rubber. Naturally it's the world's largest plant of its kind—it's in Texas.



## No Stars Sneak By Now

A NEW star or comet has little chance of getting by Harvard University on a clear night. So important is it to them at Cambridge, Mass., that they snap the skies, hoping for a new "speck" to appear on the photo plates. Any new speck is carefully checked against plates taken for a month past. If new, it's snapped by a 16-inch photo-telescope.

## Jib For Janet

IN LOS ANGELES, from whence come great airships and little oranges, now and then they take a day off to stage a regatta of an unusual kind. This one was a "sailbabies'" race. The winner, Janet Mantell, and Pat Jordan show how the sail is "lashed on."

## Photo Recorder

HERE'S a self-contained unit of meters; a twin bank of mirrors faces their dials. The dials show such meter recordings as air speed, altitude, manifold pressure, etc. The 8-mm. movie camera photos them off both mirrors, thus recording vital flight data.

## U. S. Army's Little Inch

AT THE front fighting areas motorized units devour fuel at a rate that has our Army Engineers hopping to devise methods of getting the precious stuff up front. At left, a portable pipe line is suspended over a river on a cable. The pipe, of course, is flexible. Difficulties of terrain are overcome with one engineering operation in this way, more oil reaches advanced positions much faster. And the "little inch" keeps pace with marching men and machines.

## If They Drop That Gas

LOOKS as if our protective coverings for cigarettes, etc., ended here in these deadly looking soldier packages; but these anti-gas covers are made of stronger stuff. The men inside have on gas masks, too. At Mitchel Field, New York, the Army illustrates its smallest one man unit of defense against enemy air attack with gas. You know, there's a real idea in this for you post-war duck hunters, if you substitute 12-gauge guns for those express rifles.

## Midnight Arctic Garden

GEOLOGIST SAM HOUSTON came a very long way from our deep south to try his hand at gardening in arctic Canada. At Norma Wells, North-West Territory, he was forced to wait until mid-June before sowing seed—when snow has finally melted away. Because of around-the-clock light, plants sprout like Jack's beanstalk. Three inches of growth is not unusual in a day. This is probably the northernmost garden on earth. He tends it with a grin at midnight. Are those Spanish onions growing there?

# Continent Of Tomorrow

[*Continued from page 53*]

so of this being imprisoned by jungle walls with grim Cordilleras looming in the background, a barrier to the rest of the horizon, you get a conviction that there isn't going to be any more civilization—ever! Then comes the surprise of your life.

You wake up one morning and find your lumbering, flat-bottomed old hulk tied to a concrete wharf. A spic and span little Pittsburgh rises magically out of the middle of the deep jungle. A great oil refinery is etched against the wilderness. A hundred Canal Zone type bungalows stand on stilts in orderly rows like Roxeyettes. A flock of aluminum-coated storage tanks dresses up the river bank.

This is the works of the American Tropical Oil Company. An American-built model town in the jungle. The eighth wonder of the industrial world!

Somewhere, far out of sight deep in the jungle, are the oil fields. If there ever was a bottleneck anywhere in the world, this is it. Millions of dollars worth of oil. But how to get it out and down to the sea, that was the question. American engineers tackled it. They laid a pipeline for hundreds of miles—through the deepest jungle, over the highest Andes, to the sea.

You are in treasure country now. Next day, perhaps, someone will point out a couple of extinct volcanoes to the north, and tell you with shining eyes that there lies the richest spot on earth. It is the region where most of the emeralds in the world come from.

The Spanish conquistadors opened up most of the Colombian emerald mines 400 years ago. The richest mines are those of the Muzo and Coscuez group. The Muzo mine is located down in the crater of an extinct volcano. Out of this pit of Gehenna tens of millions of dollars worth of emeralds have been taken. A gang of less than fifty miners break down the walls of the volcano with picks and crowbars. The broken quartz is collected and dumped into a sluiceway of rushing water. The quartz is then peeled off like the shell of a nut with the greatest care, for the gems are extremely fragile when in the matrix. Carat for carat, these sparkling green gems are worth three times their weight in diamonds.

So much for emeralds, for they form only a tiny part of the mineral wealth of Colombia. Colombia was the original El Dorado country, or land of gold. You can go out anywhere along the river banks and wash the soil and find plenty of what miners call "color." Between the Magdalena and Cauca Rivers there are thousands of square miles where gold is found.

As for silver, it is found in abundance and quantity only next to gold. Russia is the only country whose platinum output is anywhere near equal to that of Columbia.

Before you've been in Cali a day you will meet an American store keeper who has lived there twenty years. He will take you proudly out to his coffee *finka*. Another American will buttonhole you and tell you how he made and lost a half dozen fortunes in oil.

In Bogota, you will find oil men scrambling all over the place, trying to lease from the government some of the wild flat country near the Venezuelan border. For centuries the white man shied off from that country because of the prevalent heat and fevers, leaving it entirely to the primitive Indian. Now it turns out that the region promises to become one of the richest oil fields in the world.

All Americans seem to like the life in Colombian inland cities. They are pleasantly located on high ground and are healthy, but a bit expensive, with the peso at 50 cents. Medellin (pronounced Med-ay-yeen) with its suburbs is like Forest Hills. Cali, with its churches is like a California mission village. Bogota is like Denver, only it is a half mile higher. You will always find a small American colony.

Just outside the cities begin thousands upon thousands of square miles of opportunity. But opportunity doesn't come knocking at your door down Colombia way. You've got to go out and find it, and then you've got a job on your hands. The whole country is aching to be Americanized and only Americans can do the job. Americans installed the light, telephone and street car systems of Bogota. Or, you can join the handful of Yanks scattered over the farm—and grazing land along the Cauca River, said to be one of the most fertile on the continent. Like the Magdalena valleys, where Knight's million-acre island is located, the land is suitable for bananas, cocoa and rubber.

But what good is all this vast territory teeming with such resources, without enough trained people with modern machinery to develop it? A land ten times bigger than the state of New York, with only the population of New York City. A land of bottlenecks, its cities like islands surrounded on all sides by a sea of mountains, deserts and jungle.

For 300 years, Colombia's case had seemed hopeless; just another rich South American beggar on horseback. Then along came the solution—*the airways*. The air era was just beginning when the war temporarily clipped its wings. Airlines had doubled the rail lines and reached a total of 4,000 miles.

Give Colombia that sort of transportation service and the sky is the limit. You had better begin to make plans to get aboard.

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The original ancestor of the elephant was about the size of a pig.

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Trailer-mounted shower bath units, which pump and heat water for eight shower-bath heads, have been developed for the Army.

# Salerno Shindig

[*Continued from page 37*]

The air battle was joined and broken off so quickly that I didn't have a chance to become frightened. I was kept busy with my battle duties, but the minute the Nazi planes left, my heart began to thump and the muscles in my stomach tightened up. The uncertainty as to whether or when they would return kept me jittery and on edge. We fought off three more attacks before night fell. Once we were cloaked in blackness I felt certain that we would have a respite from further aerial assault, at least until dawn, and I flopped wearily on the deck.

No sooner were my eyes closed than Nazi bombers flew overhead and dropped parachute flares, outlining us in an eerie, frightening light. Messerschmitts, Focke-Wulfs and Junkers came out over the Gulf to send their bombs hurtling down toward us. We couldn't see them, but we certainly could hear their bombs explode and feel our ship quiver at the concussion like a hound dog coming out of water. Since we couldn't see the enemy and didn't want to betray our positions anyway, at least not more than the flares already had, our guns remained silent.

On the second day we fought off thirty-two planes without losing a minute's time in the job of unloading. The third day was even worse, although the number of Nazi planes coming at us was no greater, by now we were so weary from lack of sleep that our nerves were shot.

During the afternoon I received unexpected help. An engine wiper named Sassman, after finishing his duties below deck, came up on the bridge to spend his free time giving the Navy men a hand. He was a whiz at plane identification, having taken a course in that subject before washing out as an army pilot.

At six o'clock that night Lieutenant Thomas H. Wentz, gunnery officer, and I, were leaning over the rail, peering into the setting sun. Alongside stood three members of the crew. There was Kohn, a gunner, the short, fat, good-natured kid who kept up a running fire of conversation during battle; Carlsen, a brawny, bearded coxswain of about twenty-three; and radioman Weideman. We were all keeping sharp watch on the almost blinding sun because of the favorite German trick of hiding there when coming in for a sneak attack. There probably were some planes then, too, but none of us spotted them. All I heard was a little whisk of wind as shrapnel from a strafing plane swept the bridge.

Kohn bowled over like a log; an ugly gash in his neck pouring blood. He was unconscious when he hit the deck, dead when medical help reached him. Weideman was hit in the kidney. He sat on the deck, doubled over in agony, arms clutched about his mid-section. He was taken to a hospital on the mainland, but died two weeks later. Carlsen was wounded in both arms and both legs and he squirmed helplessly on his back. By some strange freak Lieutenant Wentz and I were untouched.

I communicated with our fleet and the following morning, in the midst of an air attack, a British cruiser pulled alongside and the body of Kohn was transferred to it. An enlisted man, a friend of Kohn's, accompanied the body to the British ship and it headed out to sea to give our gunner a decent burial.

The next morning I spotted a plane at about eighteen thousand feet. It was only a black speck in the sky and while I couldn't tell at that height whether it was friend or foe, I gathered from the direction in which he was traveling that it was a Nazi plane making a try at high level precision bombing. I saw a single pin-point of black fall away from the plane. It takes a bomb about half a minute to fall from that height. At any rate, that's what the mathematicians say. I watched it and I know that it takes half a lifetime.

It seemed to come right at me and all I could do was to stare at it in terrible fascination. I wasn't frightened. I felt no emotion. In fact, my mind was a blank as I looked on in open-mouthed amazement. Almost at the last second the slanting bomb swerved over my head and plunged into the deck of a freighter that stood near by. The struck ship seemed to leap out of the water. Flames from its deck shot skyward and the crew, racing for the rails, dived overboard. Small boats from all parts of the harbor scurried toward the burning ship, threw out life lines for the survivors.

This attack, coming on the heels of my lucky escape the night before, filled me with my first moments of real fear. From then on I really sweated out the terrible suspense between bombings. The actual attacks came almost as a relief. Despite the unceasing harassment from the air, our unloading continued and supplies kept pouring onto the beach-head.

On D plus four and D plus five the Germans came down from the hills in tanks in a vicious counter-attack and for a while the entire success of the campaign hung in the balance. But our Navy, with a pulverizing fire, drove them back to where they had come from and the bridge of ships, three thousand of them, that extended from our ports of supply to the Italian mainland, brought in enough men and equipment to rout the Germans out of their entrenched position and send them falling back on Naples.

It took us six days to unload. Late on the sixth night we weighed anchor and headed back into the Mediterranean to pick up another cargo for General Clark's Fifth Army. For the first time my weary, aching body knew the comfort of a mattress. I closed my eyes and all the torture and hell through which I had passed faded like a bad dream.

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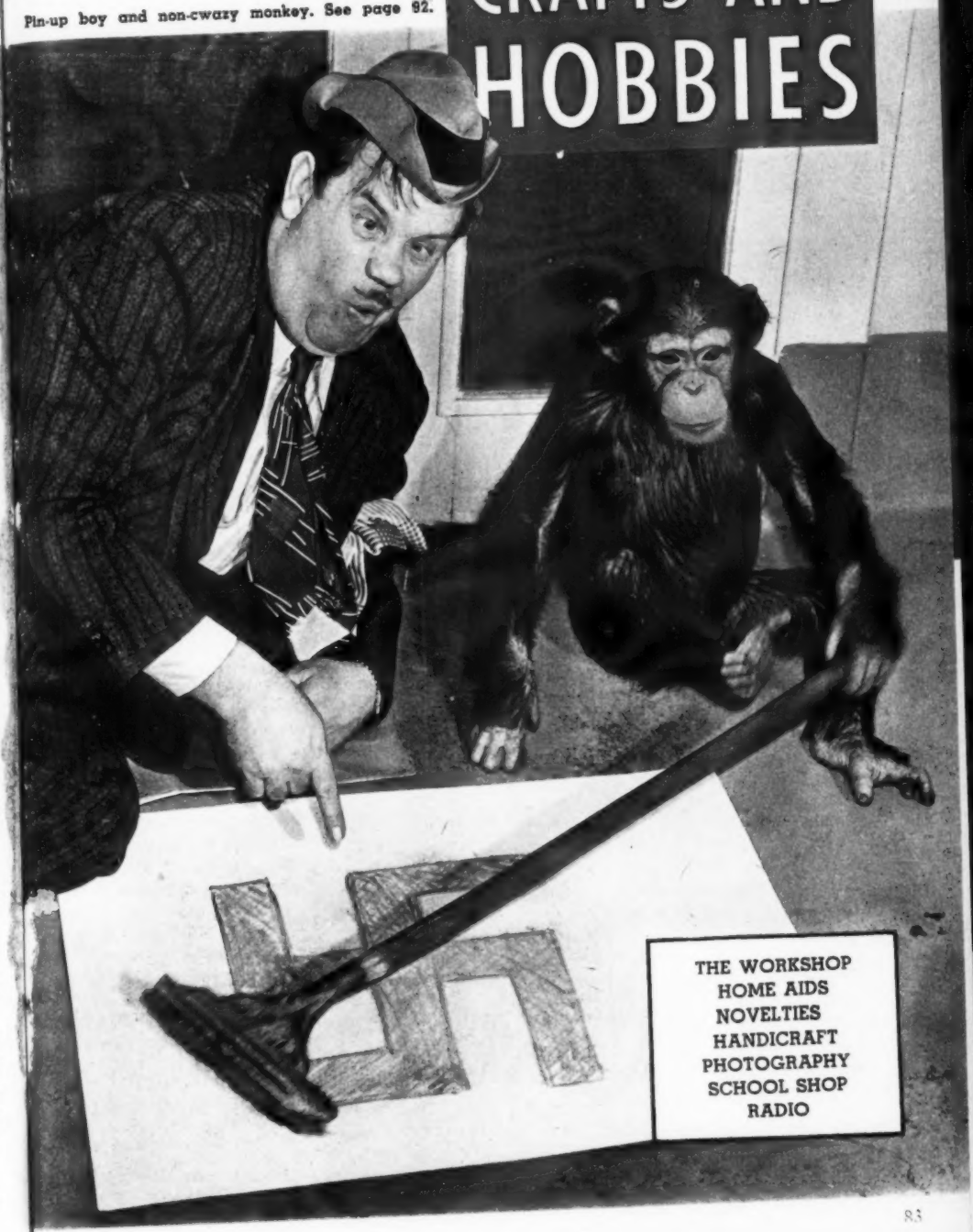
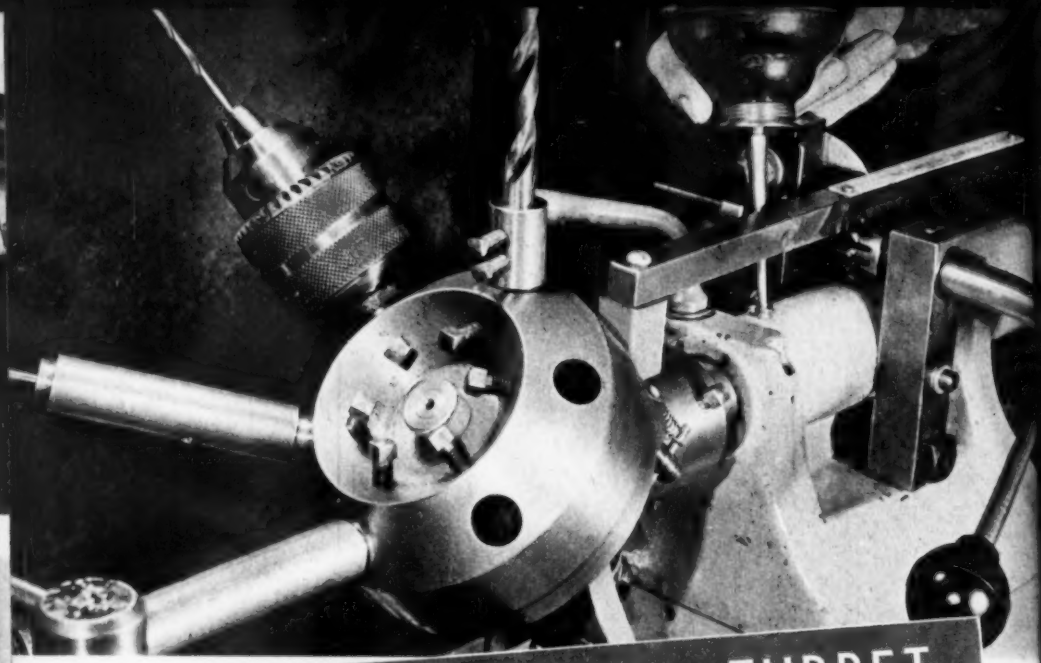
Bacteria that cause milk to sour have survived cold as low as 300 degrees below zero.

Pin-up boy and non-crazy monkey. See page 92.

# CRAFTS AND HOBBIES



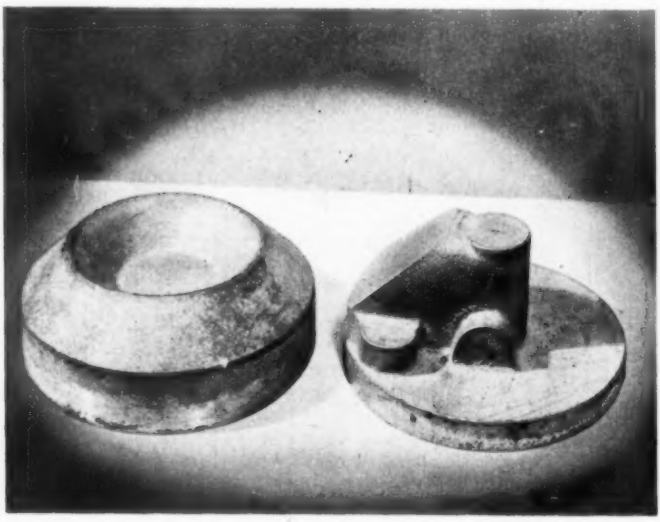
THE WORKSHOP
HOME AIDS
NOVELTIES
HANDICRAFT
PHOTOGRAPHY
SCHOOL SHOP
RADIO



# LATHE TAILSTOCK TURRET

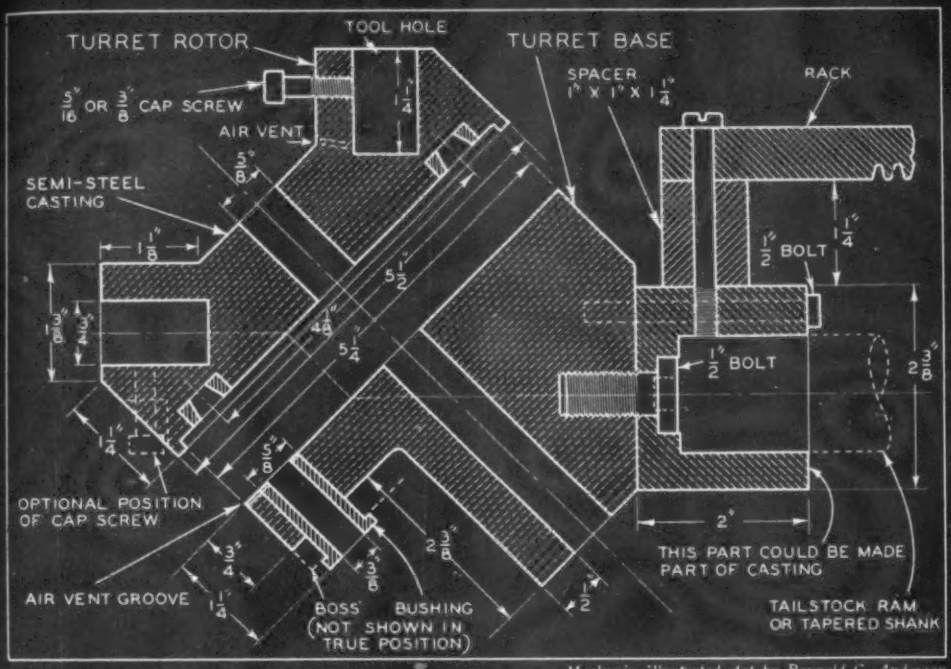
by Walter E. Burton

THE tailstock turret attachment for a metal lathe shown in the illustrations has been in use for over a year on a 14" lathe, and has proved its worth in turning out various kinds of parts for war industries. It is a semi-automatic type, meaning that, while the index pin is operated and the clamping bolt is locked and unlocked automatically, the turret has to be moved by hand from one tool position to another. The device is not equipped with individual tool stops, but this has proved to be no handicap in routine drilling, reaming, threading, and similar operations.



Left: Castings for turret and base. The material is semi-steel, stronger than cast iron.

Often, by building his own turret outfit, the shop operator can save both time and money and can make use of scrap materials that otherwise might remain idle. The chief parts required are two simple castings for the turret and turret base, a little tool steel in the form of drill rod, some cold-rolled stock for the clamping bolt, etc., and perhaps a rack and pinion and accessory materials for the feeding



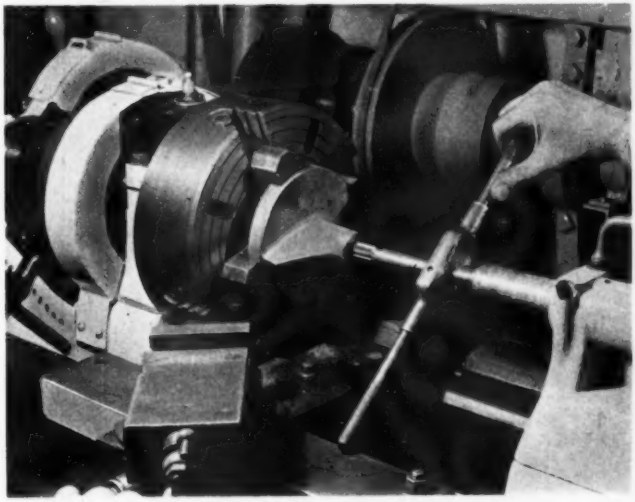

*Mechanix Illustrated Art by Reynold C. Anderson*

**Cross section through turret, giving dimensions.**

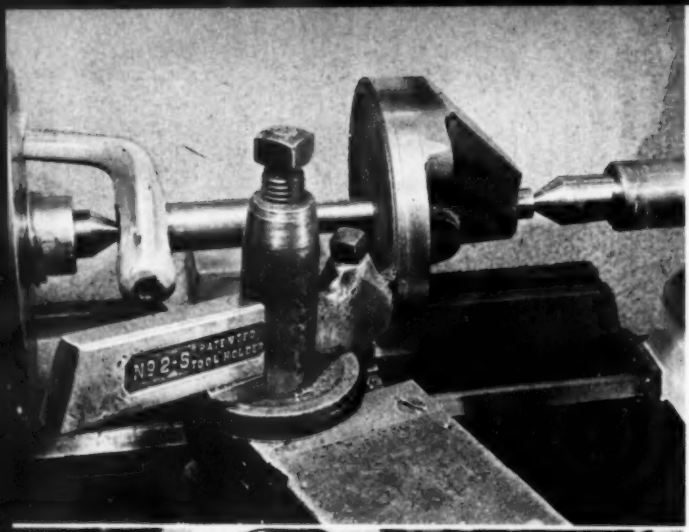
mechanism. The attachment may be used on a turnstile-operated ram like that shown; or it may be equipped with a taper shank that will fit the regular tailstock taper.

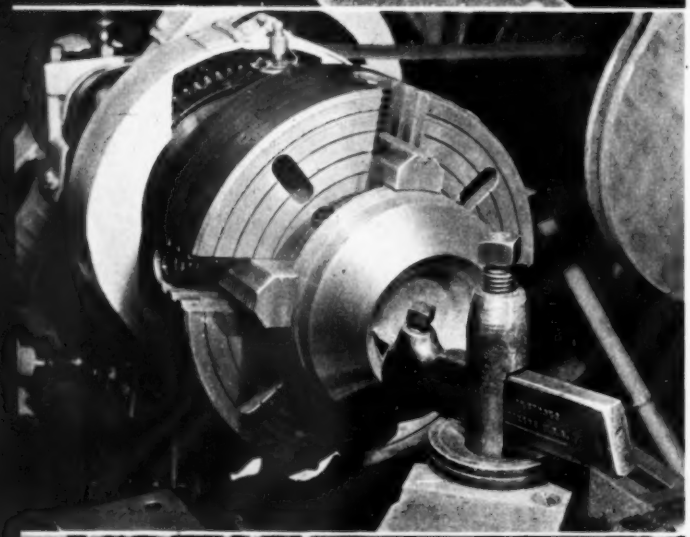
The various dimensions indicated may be regarded as optional, for you may vary any or all of them to suit your materials and ideas. The only important "must" is that the holes for the tools be lined up accurately with the headstock spindle; and since the holes are drilled and bored after the turret is mounted on the lathe, this is a simple matter. Also, the centerline of each tool hole should coincide with the centerline or axis of the turret shank or ram.

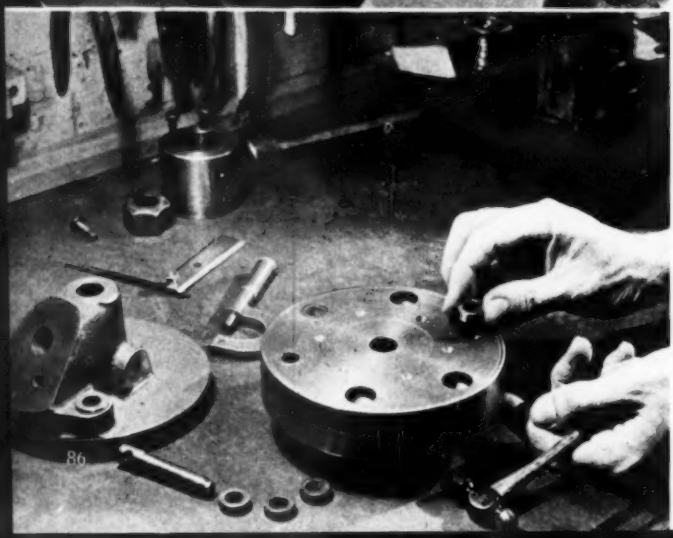
Make patterns and have semi-steel castings made for the two parts of the turret. Allow sufficient material for subsequent machining, which may be carried out with the aid of an independent-jaw chuck and a mandrel, as



**Right: Turret base is machined in 4-jaw chuck, and a hole bored and reamed for the clamping bolt. 45-degree flat area is later finished by grinding in a drill press fitted with cup wheel.**



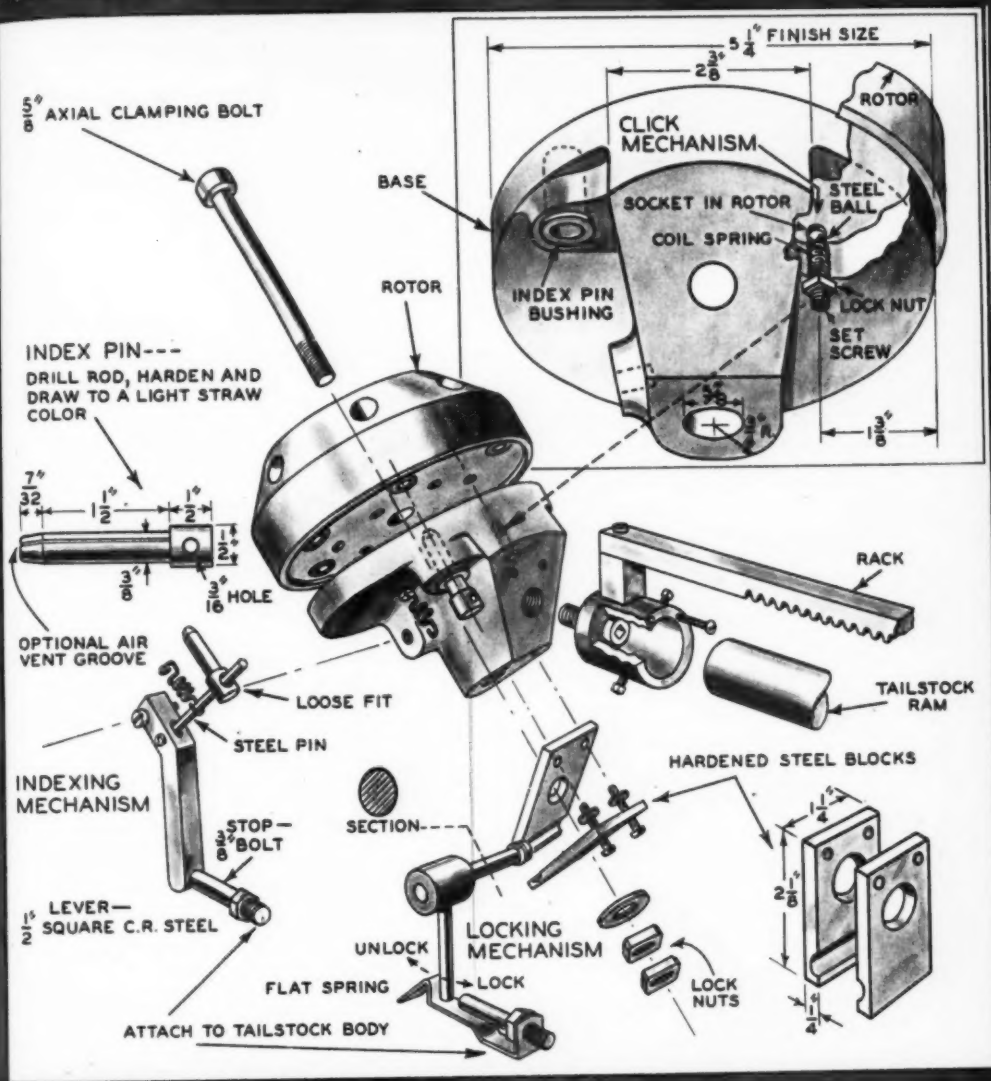


**Left: Machining the face of the base casting on a headstock mandrel.**

illustrated. The casting for the turret base shown has a flat area, inclined at an angle of 45 degrees with respect to the clamping bolt and the turret bottom, to which a ring-shaped adapter was bolted to permit fastening to the end of the ram. An alternate and perhaps better construction would be to make this adapter portion an integral part of the casting, boring a hole to accommodate the ram or the end of a taper shank. Machine the two parts so they fit together with no appreciable play; and bore and ream the holes for the axial clamping bolt.

After the castings are machined, the next step is to make the clamping bolt, which may be machined from 7/8" or 1" cold-rolled stock. Then drill the various holes for bushings, bolts, etc., in the castings. A spring-actuated steel bearing ball that pops successively into hemispherical depressions in the turret bottom serves to locate the tool positions approximately, so the index pin will be relieved of considerable wear. In the circular portion of the base, at some point about midway between center and rim, drill a hole to receive the ball and tap it part way for a set screw. Assemble the two sections on the clamping bolt and use this hole as a guide for scribling a circle on the rotor bottom. Remove the bolt and lay out the points for the ball recesses: you may use either five or six sockets, depending

**Above: Turret casting is machined as shown, then turned around for finishing outside diameter, machining bottom, and drilling clamping-bolt hole. Left: Taper-nose index pin, shown in foreground, engages hardened bushings set in bottom of turret. At extreme left is axial clamping bolt. Turret base has been drilled and the index-pin bushing installed.**




Pull-apart drawing shows assembly of entire mechanism.

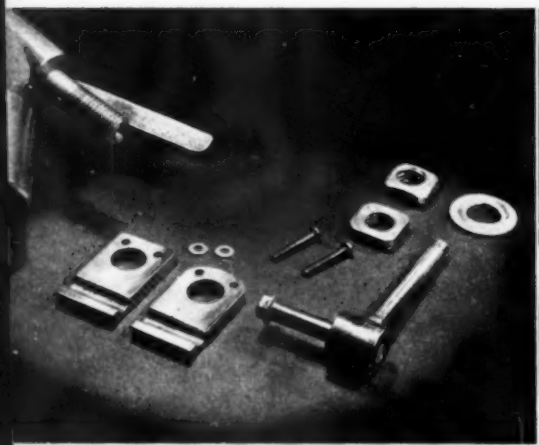
on whether you desire five or six tool positions. Drill the sockets with a bit having edges ground to a circular contour; or use an ordinary bit to spot each hole, and shape the depression by hammering the ball into it.

Machine the index pin from tool steel and make a bushing for it. This bushing may be of the same material or of bearing bronze. Harden the pin and bushing (if the latter is steel). The bushing should be a drive fit in the hole drilled for it in the base casting. Now reassemble the two sections on the bolt, install the ball and its spring, and make sure that the ball seats properly in all of its recesses. Using the index-pin hole as a guide, mark the positions for the index holes in the rotor bottom. An accurate way is to make a pin that fits snugly in the bushing, and point one end so it acts as a punch.

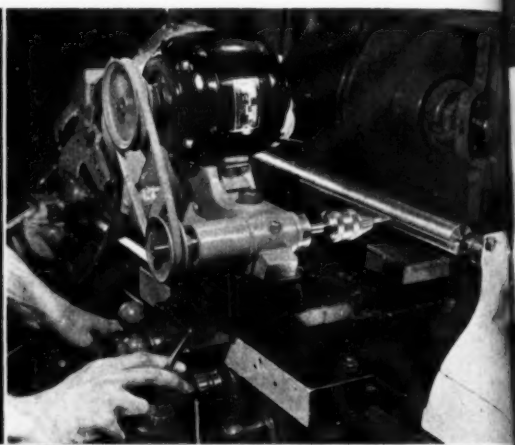
The index holes in the turret bottom are

equipped with hardened bushings recessed to accommodate the taper nose of the index pin. A taper of 15 or 20 degrees is satisfactory. Harden the bushings, grind and lap their holes to final fit on the end of the pin, and drive them into the holes drilled for them. The index pin is operated automatically by a lever arrangement, as shown. You can vary the set-up to suit the shape of your lathe tailstock body, space available beneath the turret, etc.

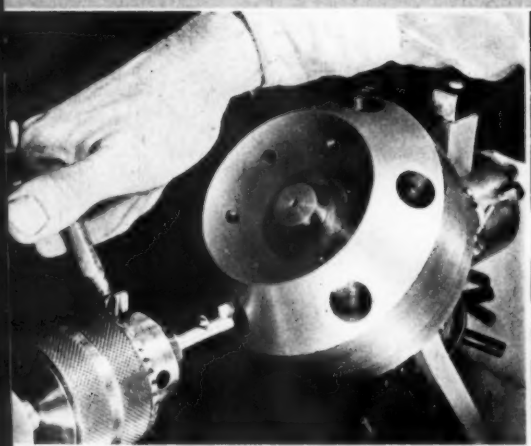
While the index pin will hold the turret in each tool position with considerable firmness if a strong spring is used on the rod that connects it and the lever, it is not adequate for resisting the forces involved in drilling, etc. So a locking arrangement that draws the two parts of the turret together by exerting tension on the axial bolt is provided. This consists of a hardened pin of elliptical cross section operating between two rectangular steel plates sandwiched between the base casting and two locking nuts on the end of the bolt. The construction of these parts is shown clearly. The rectangular plates in the photo were made from a worn-out file, and were hardened and drawn to a straw color. The arm attached [*Continued on page* 132]



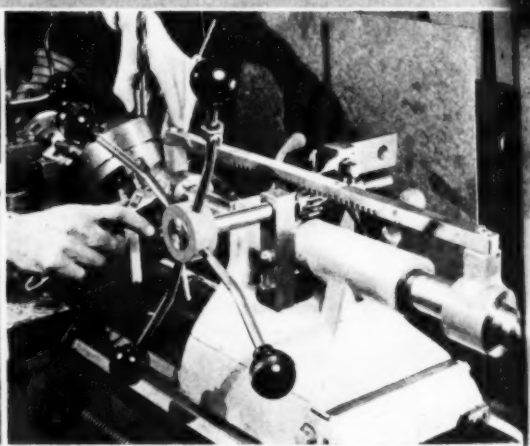
**Parts required for clamping mechanism on end of axial bolt. The two flat plates were made from an old file annealed for working, and pieces rehardened.**



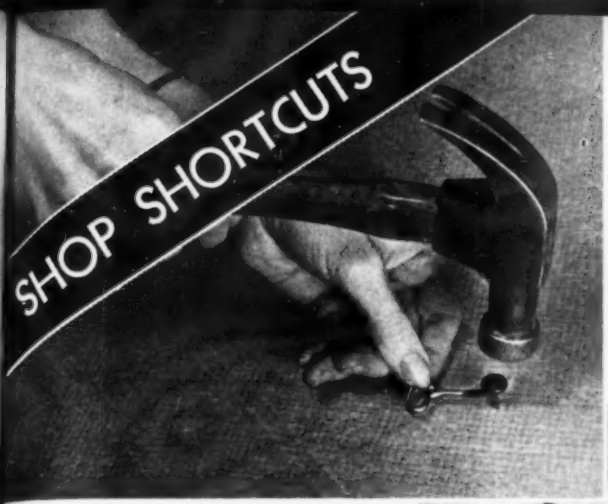
**Using a tool post grinder equipped with a chuck holding a small end mill to cut keyway in turret ram. This keyway engages a key in the tailstock body.**



**Using a fly cutter to bore the tool holes in the turret after it was installed on the lathe insuring accuracy.**



**Rack-and-pinion arrangement operated by a four-handled turnstile controls the movement of the turret unit. Note celluloid scale and pointer on top of rack.**

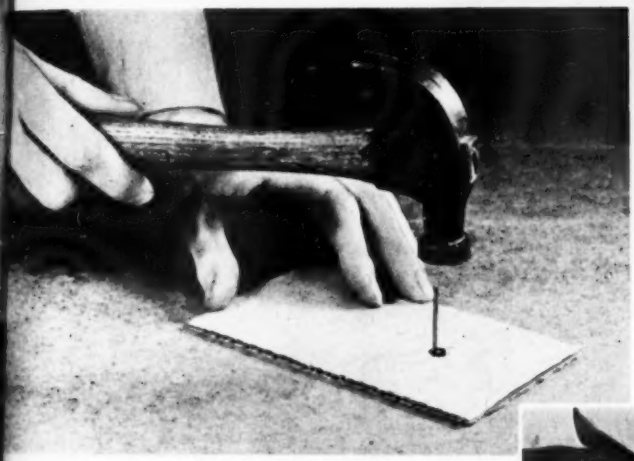



## Tack Holder

THIS trick will come in handy the next time you have small tacks or nails to drive in hard-to-reach places. Take a slotted key of the type used for unwinding the metal strips from sardine cans and cut off the end, forming two projecting prongs. The tack or nail inserted between these prongs will be held securely for hammering.

## For Stripping Wire

WIRE insulation can be removed quite easily, without damaging the wire itself, with the aid of a claw hammer as shown. Do not attempt to remove too much insulation at one time, however; 2-inch sections are best.



## When Driving Nails

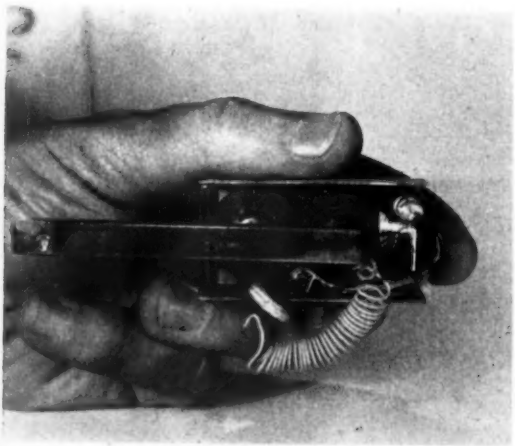
FREQUENTLY the smooth surface of wood can be marred by hammer scars when it is necessary to use nails in assembling. If a sheet of corrugated cardboard with a hole punched through it is used as a protection as shown, all such scars will be avoided.

## Handy Bag For Tools

THIS kink is an extremely simple one, but nevertheless it is one which the handy man will find very effective. For carrying around the few tools necessary for repairs around the apartment house and office, use an old, discarded pocketbook. It is not as heavy as a tool box and is easily carried. Zipper kind is best.

Shaping Willie's body (above) and vibrator chamber (below).

# *Willie Woodpecker* KNOCKS ON YOUR DOOR

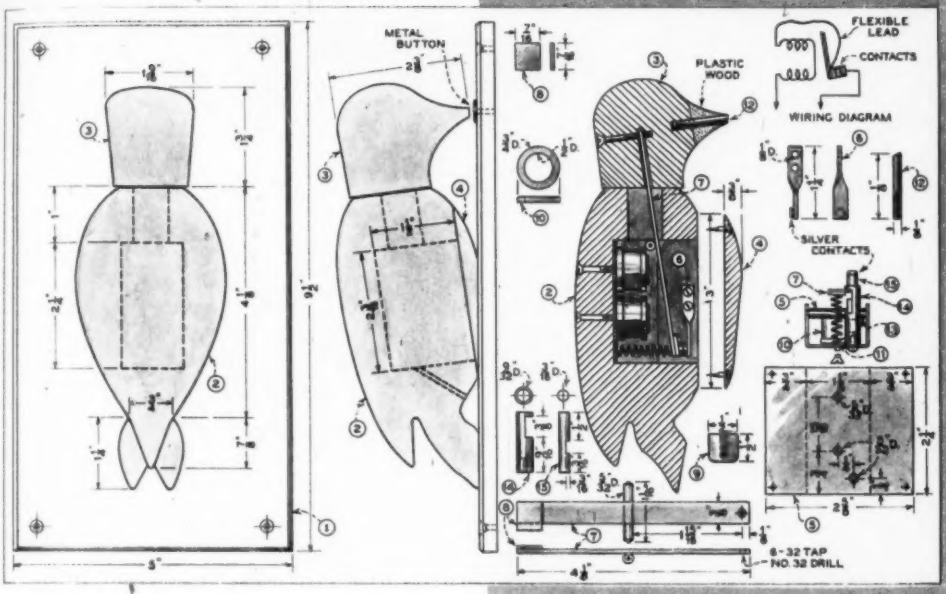


Vibrator unit, showing flexible wire and contact.

by Walter B. Ford

THIS electrically operated door knocker may be built from odds and ends of material usually found around the home workshop. Owing to the delayed action of the contacts which is incorporated in the vibrator unit, the natural "tap-tap-tap" sound of the woodpecker is produced when the push button is pressed.

The body of the woodpecker is cut roughly to shape with a jig saw from a piece of soft pine, after which it may be finished with a knife and sandpaper. Before the body is completely finished, the chamber for the vibrator unit should be chiseled out to the size shown in figure 2. Drill a 5/8" hole




*Mechanix Illustrated Art by Reynold C. Anderson*

from the upper end of the body to connect with the vibrator chamber. Drill a ⅛" hole from a point near the tail to the vibrator chamber for connecting wires. The breast cover, figure 4, is made from a separate piece of soft pine and should be placed in position temporarily before the body is finished, so that it may be sanded to the correct contour with the body. The head is cut to shape from a piece of soft pine [*Continued on page* 132]

**Screw holds head to armature bar within.**

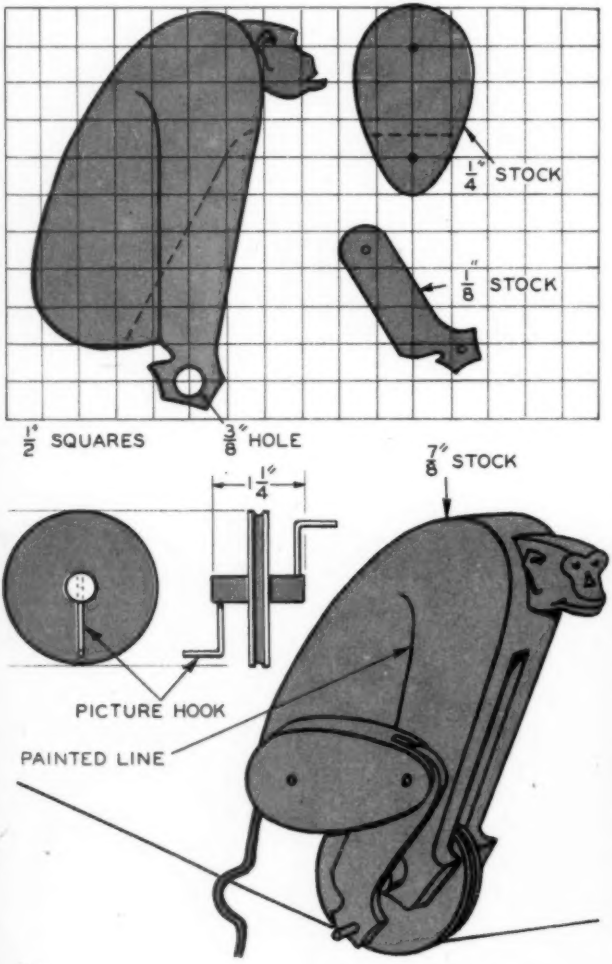
**Vibrator unit (above). Paint Willie with enamel.**

# Who said animals are

**At left we see the perpetr-r-rr, perpetr-r-rrr (gulp), pwomoter of der idea that animals, ezpezially monkeys, are cwazy. He should talk like that! Hmmm. . . .**

WHO said animals are cwazy? Why, of course, it must have been our old friend, Lew Lehr, who has been carrying out his propaganda campaign to that effect for some time now, via the newsreels. His famous "monkeys are the *cwaziest* people" has had audiences rolling in the aisles from coast-to-coast, and who are we to say he's wrong?

In spite of all this, we've managed to dig up a trio of animals who aren't a bit "cwazy," even though the kids may think they make like it when they start playing with them. These animals are of wood, designed by a well-known modern industrial designer, Paul A. Lobel, whose work is familiar to many MI readers. The monkey, kangaroo and dachshund will perform amusingly happy antics for the children, and you can knock them out in your workshop in a jiffy.

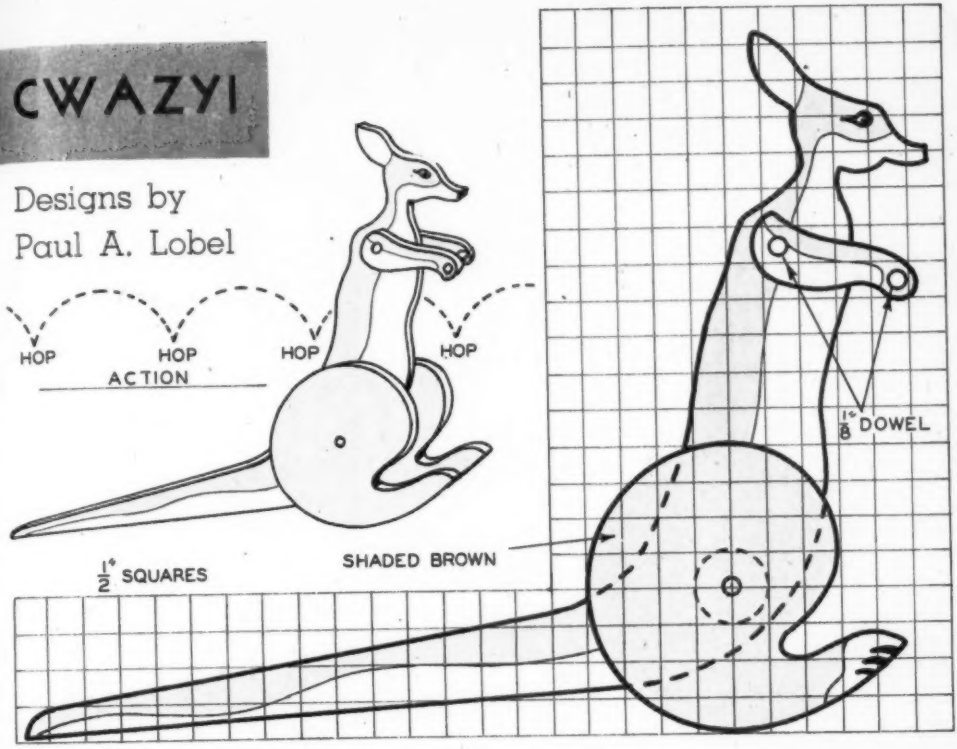



## Slack Wire Artist

Let's begin with our monkey, the champ of chimps, whom we shall call "Lew" out of respect for his greatest booster. Mounted on a one-wheel bicycle he travels on a slack wire from one end of the room to the other. He goes from an imperceptibly slow start to the dizzy pace of a six day bike

# CWAZY!

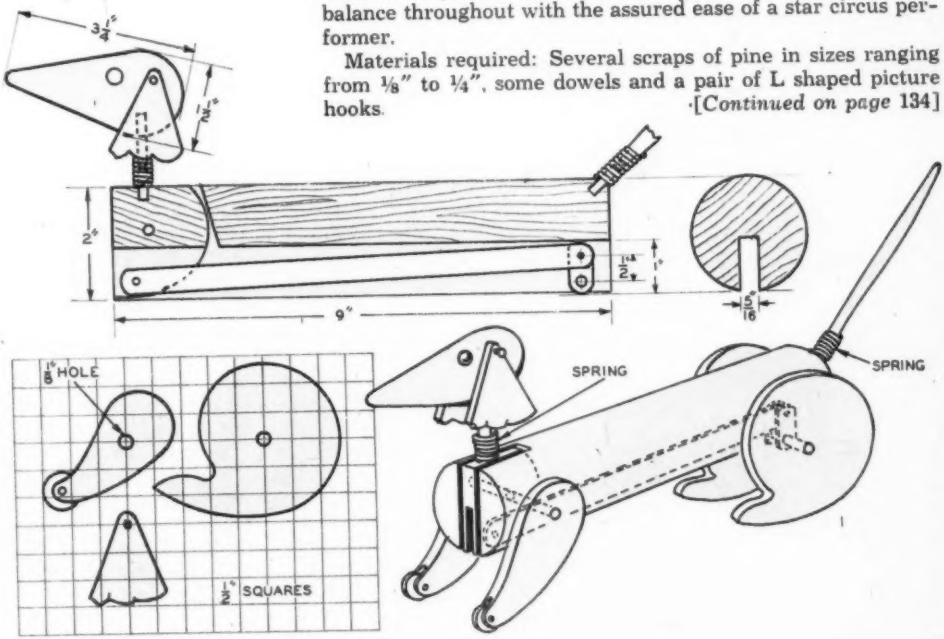
Designs by
Paul A. Lobel

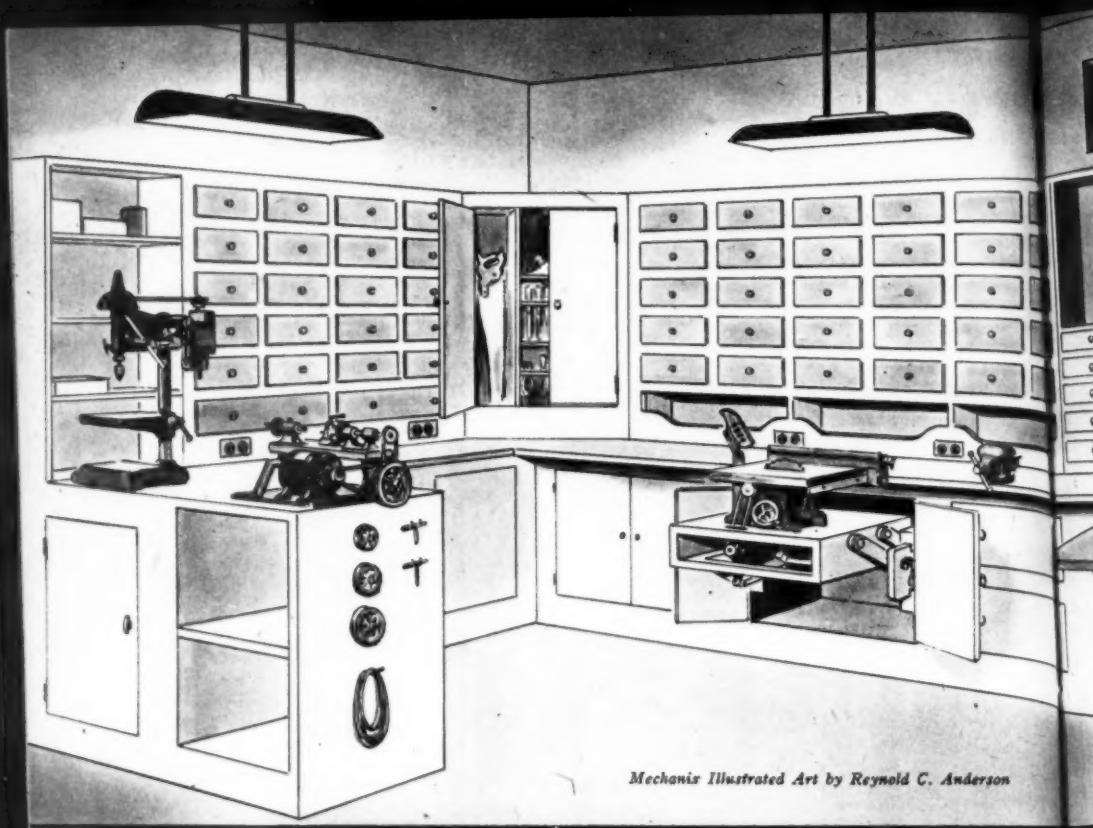



rider in a prize-winning spurt, maintaining his poise and balance throughout with the assured ease of a star circus performer.

Materials required: Several scraps of pine in sizes ranging from 1/8" to 1/4", some dowels and a pair of L shaped picture hooks.

[*Continued on page* 134]





*Mechanix Illustrated Art by Reynold C. Anderson*

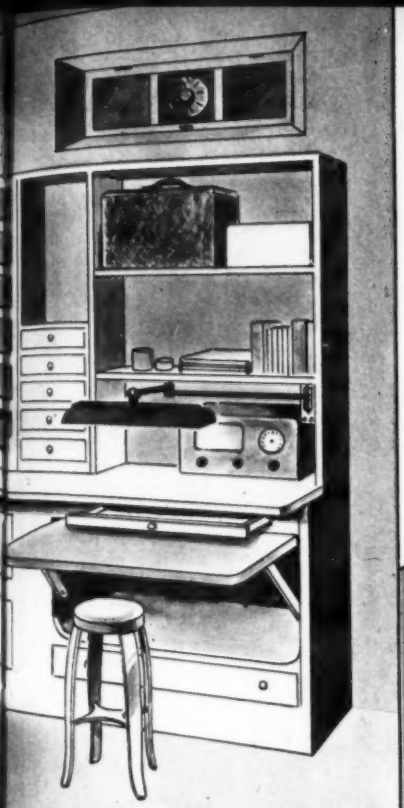
# *Your* POST-WAR WORKSHOP

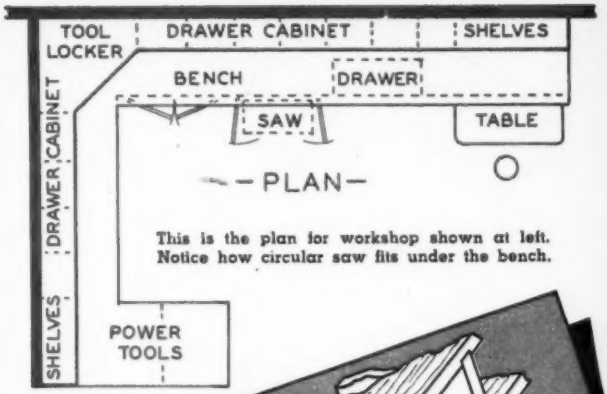
by William F. Crosby

THE home workshop is essentially an American institution for American men and women who like to tinker and make things: models, furniture and what have you. Supplying home workshops with tools, both power and hand, has developed into a big business and, before the war, it was possible to buy inexpensive and well-designed light power tools that were quite capable of satisfying even the most particular hobbyist.

Unfortunately, many of the pre-Pearl Harbor home workshops were not laid out with care, and some of them just grew until they sprawled all over a basement or an attic with no rhyme or reason to the layout and certainly no efficiency of operation. When the war is over you'll want to correct this and revise your shop to be in tune with the new conveniences and ideas to come. The layouts shown here will be found to be entirely practical for most post-war workshops, and if they are not just right, they can be modified to suit the requirements.

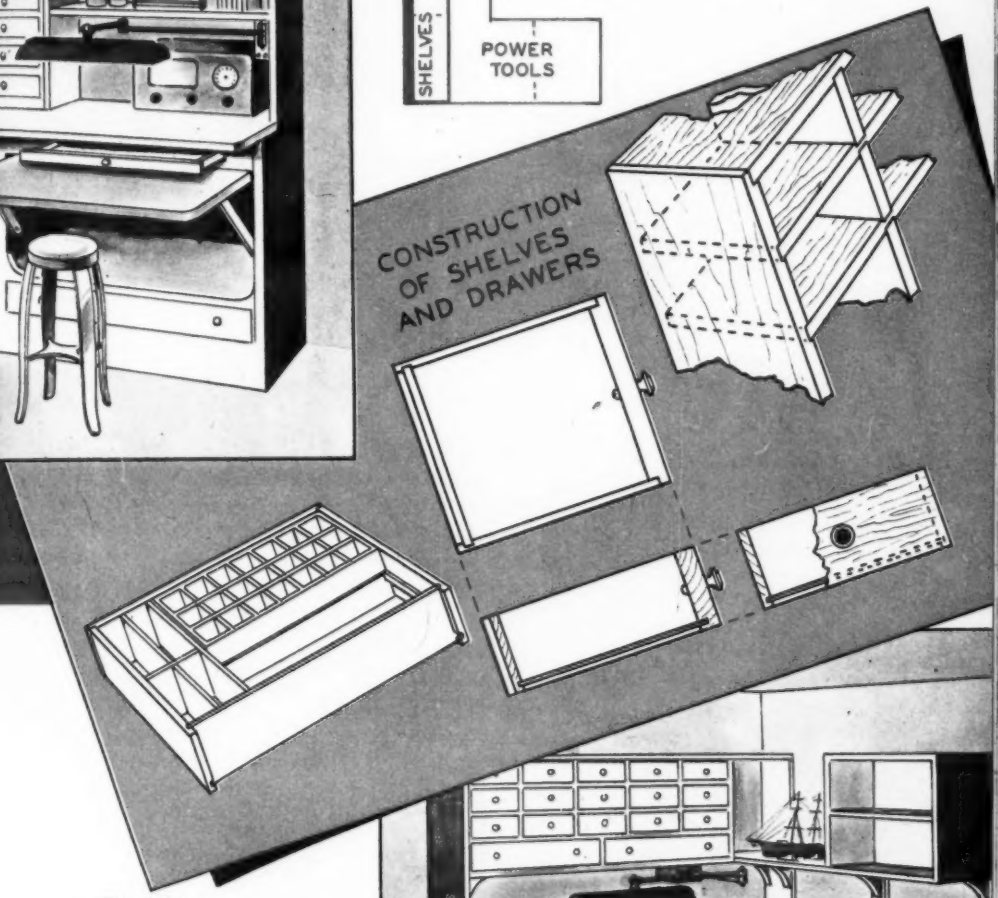
The smaller layout of the two is enclosed in a space exactly 4'x6' and might easily be placed in that oversize closet in your apartment. The perspective drawing and the plan view are shown on the opposite page. The work bench fills two of the walls, and each bench is 21" in width. Underneath the left-hand bench are two drawers and two cabinets with hinged doors. The drawers may be subdivided as required, and in back of the doors there may be shelves or just open spaces in which materials may be kept. Above this part of [*Continued on page* 138]



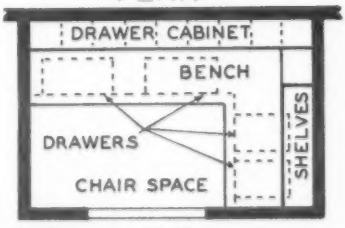



—PLAN—

This is the plan for workshop shown at left. Notice how circular saw fits under the bench.



—PLAN—



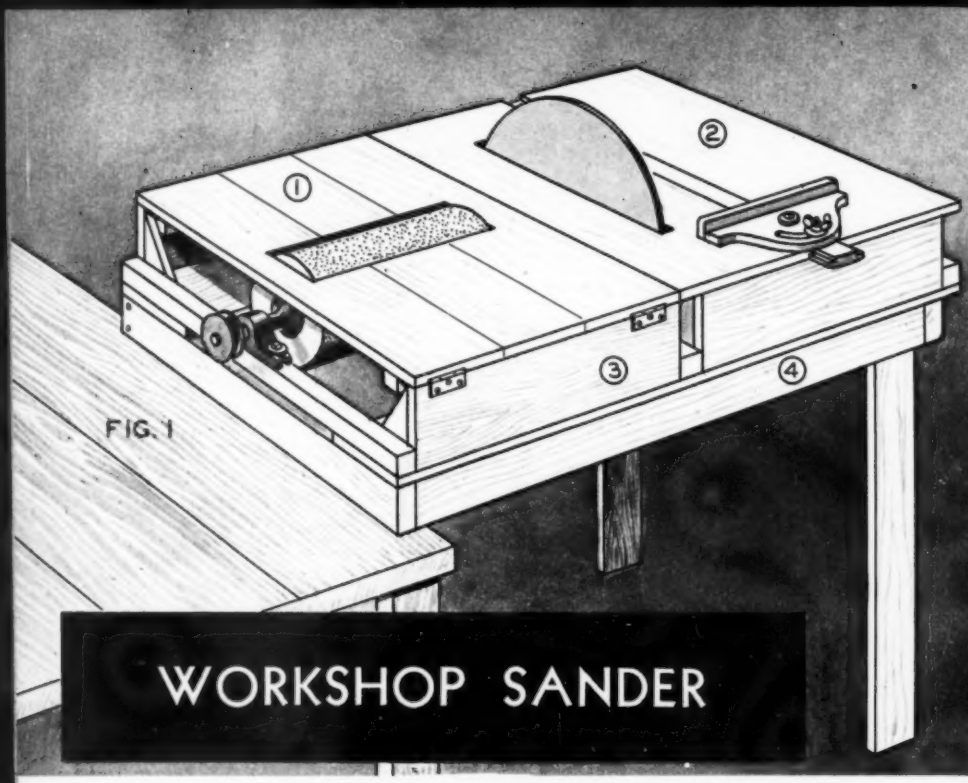



FIG. 1

# WORKSHOP SANDER

**If you've always wanted a good power sander for your shop, here's your chance to have an efficient combination drum-disk unit—at practically no cost!**

by A. H. Smith

*Mechanix Illustrated Art by Reynold C. Anderson*

THE satin smooth, lustrous finish which characterizes the handicraft of the painstaking worker is frequently the result of many hours of sanding before the actual finishing is done. This is especially true where the finish is a stain, although it is almost, if not quite, as necessary where paint or lacquer is to be used. It is axiomatic that a finish can be no better than the surface to which it is applied, hence the importance of sanding to produce a flawless surface if the final project is to be one in which the craftsman can be justly proud.

Sanding is not an easy job; in fact, done by hand, it is undoubtedly the most fatiguing and certainly the most tedious work encountered in the home workshop.

Here is a combination drum and disk sander which will save hours of hard labor in the average workshop and do a better job than can possibly be done by hand.

In designing this sander a prime object was to eliminate as much as possible any metal parts or to use only those easily obtained. The dimensions shown in the illustrations may be changed to fit available materials and individual requirements. The original sander built by the writer used a disk 10″ in diameter, and a drum 4½″ in diameter and 9″ long. The overall size of the top, which was made of ¾″ pine, is 28¼″ wide by 18″ deep.

Surfaces are sanded on the drum; ends and sides on the disk. End grain of sawn parts are especially difficult to sand by hand, but with this sander end grain is sanded true and smooth in a few seconds, thus eliminating rounded edges and assuring perfectly fitting parts.

Since it is difficult, if not impossible, to obtain motors for home workshops, the sander may be powered by the same motor used for other pieces of equipment. The plan in Fig. 1 shows a simple method whereby a single motor is used to power the sander and the M. I. Victory Model Saw (described in the December, 1943 issue of MECHANIX ILLUSTRATED).

If a ¼-h.p. motor is being used, it is advisable to slip the belt from one tool while using the other to avoid overloading the motor.

## Construction

The construction, as indicated in the illustrations, is extremely simple, and represents only a few hours work. Fig. 1 shows the sander completely assembled.

The *top* (Fig. 2) is made in two sections (Pc. 1 & 2). A ¾" clear pine will be found satisfactory. It is advisable to make Pc. 1 of 12" wide stock, although if not readily available narrower wood may be used if properly cross-battened. The rectangular opening for the drum is centrally located and cut with a bevelled front and back edge so that the top surface may be kept as close as possible to the drum, as shown in the cross-section detail inset. With a 4½" diameter drum 9" long, the

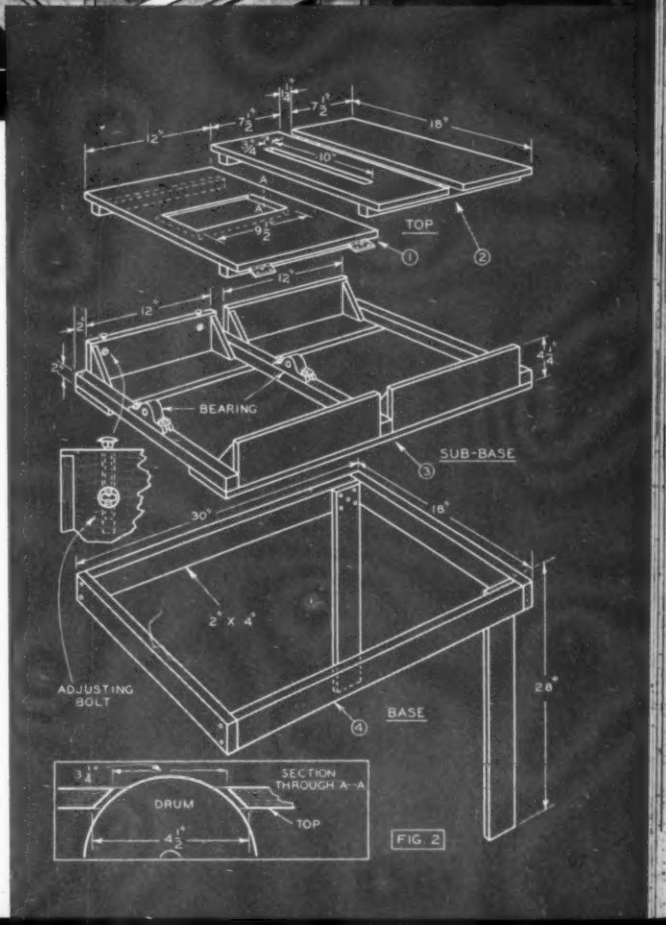


FIG. 2

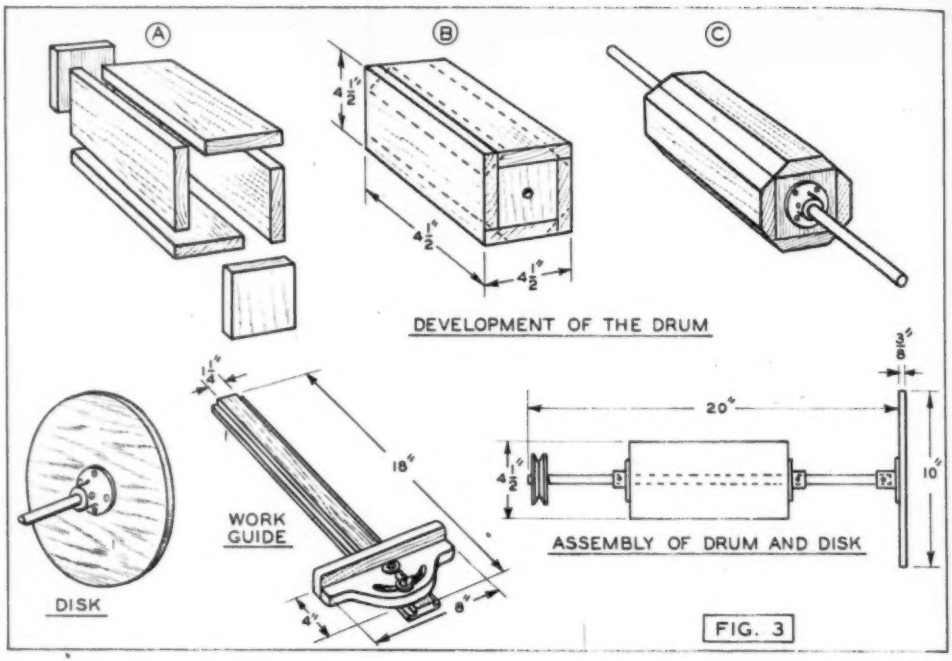



FIG. 3

opening should be cut 3¼" x 9½" and bevelled to 4½". This will permit ample projection of the drum above the top surface. To prevent warping, a pair of battens is screwed to the under surface. This section of the top is made adjustable by hinging to the sub-base.

Adjustment of the surface of the top in relation to the drum is made by means of adjusting bolts in the sub-base, later described. The other top section (Pc. 2) is made of two ¾" pieces 7½" wide. A cutout ¾" wide is made in one piece as shown, to accommodate the disk, the length of the cutout depending on the diameter of the disk used. This section is screwed to two battens. The other section is screwed to the battens, leaving a 1¼" space in which the work guide shaft will slide.

The *sub-base* (Pc. 3) is constructed of ¾" stock, except the lateral members which should be approximately 2" x 2". The height of the upright members should be such that when the drum is mounted it will project approximately ½" above the surface of the adjustable top (Pc. 1) at its lowest position, that is, when the top is resting on the upright members. The upright members are screwed to the longitudinal members and braced with triangular braces. The adjustable top (Pc. 1) is hinged to the upright member.

To provide critical adjustment of the top in relation to the drum a simple bolt and nut arrangement is used. Two $\frac{5}{16}$" holes are drilled vertically in the back upright member. Holes, of a diameter to permit snug insertion of square nuts for ¼" carriage bolts, are drilled horizontally through the center line of the vertical holes as shown in the inset, Fig. 2. The hinged top (Pc. 1) rests on the heads of the carriage bolts so that turning the bolts raises or lowers the top, thus providing fine adjustment. Once the top is adjusted, the adjusting bolts will seldom be used, but this feature should not be omitted as it is essential that the drum have a uniform projection of about $\frac{1}{16}$" throughout its length above the surface of the top and it is difficult to obtain this uniformity without some method of compensating for small errors in construction.

For mounting the drum two ½" bearings (ordinary pillow blocks) are bolted to the lateral side and center members.

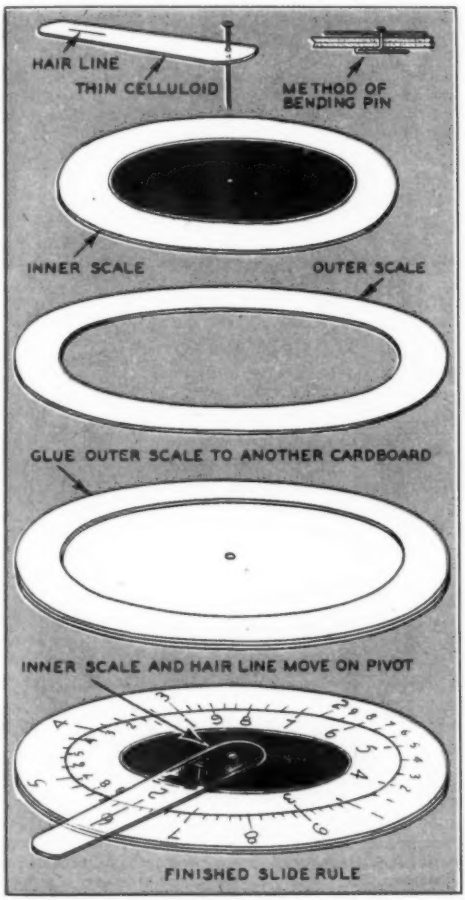
The *base* (Pc. 4) may be any rigid table of a size to accommodate the sub-base. If an arrangement such as shown in Figure 1 is used in order to utilize one motor for the sander and some other power tool, the sander should be mounted [*Continued on page* 138]

# VEST-POCKET SLIDE RULE

ENGINEERS and students, as well as the average layman, will find this tiny slide rule extremely useful for making quick computations. Since the scales are layed out in the form of a circle, the equivalent of a 6" slide rule can be realized using only a 2½" disk.

The slide rule face, as shown at the right, should be clipped out and glued on a piece of thin fibre or cardboard, after which the inner and outer scales are separated by cutting along the dotted line. The outer ring is then glued to another piece of similar material. The hairline is made of thin celluloid with a line inscribed along the center. This line can be ruled with a needle and filled with India ink or grease crayon for better visibility. The rule should be assembled in such a manner that both the inner disk and hairline can be rotated freely and independently of each other. Details of the assembly are shown at the left. A thin coat of clear shellac should be applied to prolong the life of the rule.

GLUE SCALE TO CARDBOARD AND SEPARATE INNER AND OUTER SCALES BY CUTTING ON THE DOTTED LINE




The operation of this rule is similar to any straight slide rule, but for the benefit of those readers who may not know how to use one, the following instructions are given.

To multiply one number by another—say 250 x 320—set the hairline to 2 5/10 on the outer scale to represent 250. Revolve the inner scale until the index, 1, is also lined up under the hairline. Then rotate the hairline and set it to 3 2/10 on the inner scale to represent 320. Read the resultant product under the hairline on the outer scale, which in this case is 8. By mentally calculating the approximate answer to determine the location of the decimal point, we find the product 250x320 = 80,000.

To divide one number by another—say $\frac{7600}{5800}$ set the hairline to the numerator, 7 6/10, on the outer scale to represent 7600. Turn the inner scale until the denominator, 5 8/10, which represents 5800, is also lined up under the hairline. Shift the hairline to the index, 1, of the inner scale and read the quotient under the hairline on the outer scale, in this case 1 3/10+. Again determining the position of the decimal point mentally, we find the answer $\frac{7600}{5800}$ = 1.31. If the rule is used and constructed carefully, its accuracy will be better than 1%.—*B. S. Branch.*

# ART in

This is one of Madeline Stone's masterpieces. Recognize who it is? It's none other than our old friend, Elsie, the contented milker.

Chisels, saws and axes are tools of the trade. First we start off with some ice—our sculptress at the left has fifteen hundred tons of it at her disposal—and then we commence chipping it to the desired shape.

At the right our figure is beginning to take form: we can see a couple of arms and something which looks like a head, but that piece sticking out of the back has us guessing. What can it be?

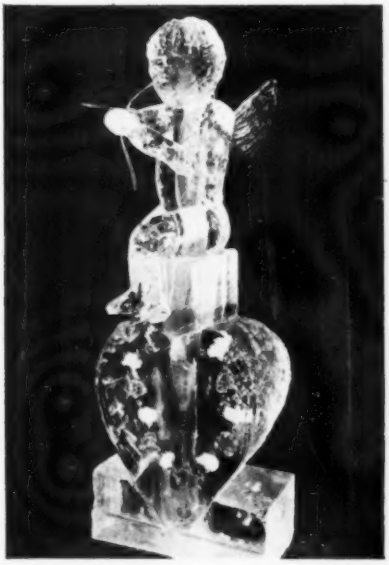
This is a little better, but we still don't know what that back piece is. Incidentally, notice Madeline's heavy coat (she has a sweater underneath), big warm scarf, woolen socks over her stockings, felt boots and galoshes. No need to wonder what those are for!

# in an ICEHOUSE

HERE is a young lady who has one of the most unusual jobs we've heard of in a long time. She is Madeline Stone, art student at the Vesper George School at Boston, Massachusetts and ice sculptress at the Boston Ice Company. After school each day she retires to the freezing climate of her icy studio, puts on her Arctic overcoat and starts hacking, sawing and chiseling away at a few tons of ice, turning out everything from crystal-like glasses to battleships. Now that Old Man Winter has a good grip on the thermometer and is keeping the mercury pretty well below 32° (for us folks above the Mason and Dixon Line, anyhow), let's take a tip from Madeline, get ourselves some ice, go outdoors and do a little chiseling of our own.

**The finished ice figure is shown below. It's a Valentine piece, Cupid with a drawn bow perched on a large heart. That back piece turned out to be his wings. Brrrrr! We'll bet this is a cold-hearted Cupid!**

**Ice sculpture is a cold job, and in her 28° F. studio Madeline can keep her objets d'art in perfect condition until sold. In your home ice pieces will last for six hours; outdoors in Winter they'll last for six weeks**



**There is no end of objects to be made in this craft, and your materials cost a few pennies. In the photo at the right are centerpieces, serving bowls for shrimp and grapefruit, punch bowls, etc. Once in a while Madeline turns out a 30-ton battleship, a 6-hour job.**

# THE SCHOOL SHOP

Conducted by Gilbert Paust

*Lieutenant, Civil Air Patrol, Westchester Squadron*

## Lesson 12—Cloud Types and Formations

METEOROLOGY is the study of the earth's atmosphere. Most of us go through life, performing our daily chores, without paying too much attention to the ocean of air about us. We run for cover when it rains and walk in the warm sunlight when the clouds disappear from the sky; we watch with awe the lightning leap from a thunderstorm and photograph or paint the beautiful, billowy clouds of a summer afternoon. But here our interest ends, and we are missing some of the most fascinating facts mother nature has to offer.

In these lessons on meteorology we are going to learn about the clouds and what they mean to a pilot, instruments for measuring the meteorological elements, maps and charts, winds, fronts, fogs, storms and the hazards of icing. None of the ideas are hard to grasp, and I'm quite sure you'll consider this subject one of your favorites when we've finished. Those of you who dislike mathematics of any kind can cheer up because we'll strike it only once in the problem of calculating cloud ceilings.

The first subject for our consideration is clouds. What are they? They are composed of particles of moisture which have been condensed from the air on small bits of dust which are floating all about us in the atmosphere. How this condensation takes place is a story we shall postpone till another time. Clouds vary as to shape, size and altitude and are classified in four groups or "families." I shall introduce you to these families and describe their members so you will recognize them the next time you meet them. Here they are:

*High* family, usually starting at 20,000 ft.

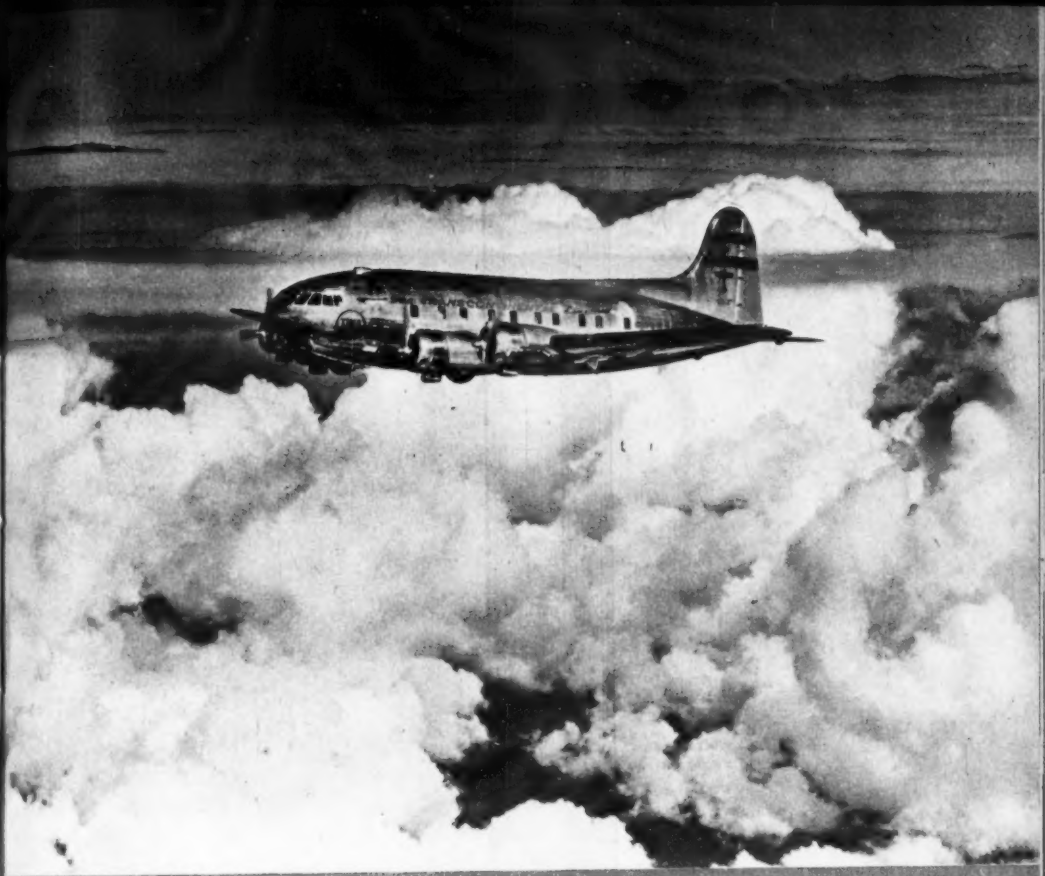
1. Cirrus
2. Cirrocumulus
3. Cirrostratus

*Middle* family, usually starting at 6,500 ft.

4. Altocumulus
5. Altostratus

The wispy cirrus "mare's tails" are ice crystals.

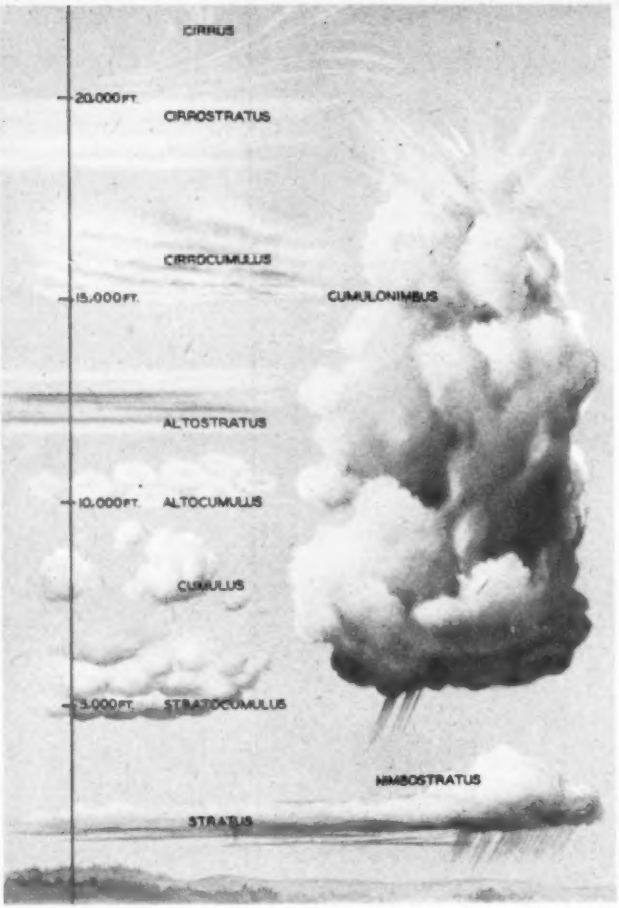
Cirrocumulus clouds are tufts at high altitudes.



The Stratoliner skims the tops of billowy cumulus clouds. Notice cirrostratus just visible in the background.

Cirrocumulus like rippled sand is "mackerel sky."

Altocumulus is a tight pattern of cumulus tufts.




*Mechanix Illustrated Art by Fred Ripperda*

*Low* family, usually starting at 1,500 ft.

6. Stratus
7. Stratocumulus
8. Nimbostratus

*Vertical* family, extending from 1,500 ft. through all cloud levels including *high* family

9. Cumulus
10. Cumulonimbus

Now for some key words to help us describe them and keep them in their proper groups. Any cloud name including the word *cirrus* or *cirro* belongs to the *high* family. The word *cirrus* sounds like the word *ice* and this will be our clue because all clouds of the *high* family are composed of ice crystals due to the extreme cold of the upper altitudes.

All *alto*-clouds belong to the *middle* family; that's a simple fact to remember. All clouds in the *low* family contain *strato*—in their names (except the *stratus* itself), but don't overlook the fact that some of the higher clouds are *stratus* combinations also, such as *cirrostratus* and *altostratus*.

Here are some more hints to help us remember. The name *cumulus* sounds like the word

Stratocumulus is low, rolling, threatening layer. Anvil-shaped cumulonimbus is the "thunderhead."

**You'll get a real thrill when you first fly through small cumulus clouds which form at low altitudes.**

*accumulated* and this describes the cloud. The *cumulus* cloud shapes (or *cumuliform* clouds as they are sometimes called) are tufts of clouds, floating in the sky separately from the general cloud masses. The *stratus* combinations (the name resembling the word *straight*) are flat, sheet layers. The word *nimbus* or *nimbo* indicates a rain cloud. Now let's go down our list and see what we have.

1. *Cirrus*—Sounds like *icy* and is therefore a *high* cloud. They resemble thin wisps and are composed of ice crystals. Sometimes called "mare's tails."
2. *Cirrocumulus*—The form *cirro* tells us they belong to the *high* family; the form *cumulus* tells us they are cloud tufts. Putting the two together we have the description; tufts of cloud at very high altitudes, composed of ice crystals. A formation of them resembles rippled sand. They form a "mackerel sky," forecasting bad weather.
3. *Cirrostratus*—*Cirro* means *high* family and *stratus* means sheet cloud. From these we have: a sheet or layer of cloud at high altitudes and composed of ice crystals.
4. *Altocumulus*—*Alto* indicates *middle* family; *cumulus* means tuft clouds. These tell us that this cloud is a series of tufts forming at moderate altitudes. Its appearance is that of many rows of sheep standing close together. When flying over an *altocumulus* roof you can imagine yourself flying over a white turbulent ocean.
5. *Altostratus*—*Alto* indicates *middle* family; *stratus* means sheet cloud. This

[*Continued on page* 136]

# IDEAS FOR SERVICE MEN

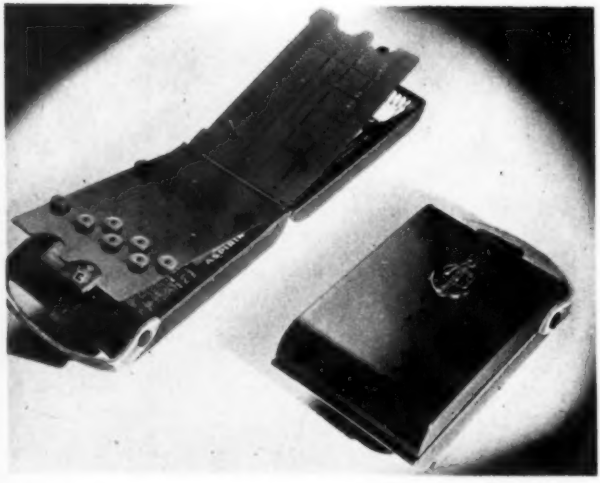
NOW THAT THE HOLIDAY SEASON is over and you're all settling back into the channels of your post-New Years daily lives we have an appropriate item from Pfc LeRoy Lincoln, APO Seattle, who says: "Into each G.I.'s Army routine a little K.P. must fall. This means WORK, and anything to ease the toil is more than welcome. I don't know the origin of the following idea, but I've used it many times with success.

"To aid in lining up the bottles and jars of sauces and jams that are left on the mess table from one meal to the next, tie a long line to two knives. Accurate alignment is then easily obtained by stringing the line along the center of each table. This eliminates the curve created by even the best 'naked-eye' sighting."

PVT. JACK C. TWELE OF CAMP BOWIE, TEXAS, has a suggestion for radio fans who are quartered in a crowded barracks where several "portables" may be going at once, tuned to different stations, or where you can't turn on your set for fear of disturbing the next man. Jack went to a radio store in town and bought a cheap pair of headphones and phone jacks. He installed the latter in his radio by means of a simple hookup. Now he can listen to his favorite programs without interference or shouts of "turn it off!" Total cost was less than $2.50. The radio man will tell you how to connect the phone jacks when you get them.

NEXT COMES ONE FROM PFC. JOHN G. WATTMAN, USAAF, Geiger Field, Washington, that'll literally TIE you in knots. Quote:

"No need to tell service men how easily their cotton khaki neckties become soiled and wrinkled after a couple of wearings. Washing them is no problem, but how to get a decent pressing job is another story, particularly in those outfits where



**The compact Lumarith plastic 4-in-1 kit shown at left is designed to supply a soldier on the march or a sailor at sea with almost every small article he needs. The pack is 4"x6½" in size and has four sections, two of which are game boards notched to hold checkers and cribbage pins. Remaining compartments hold mirror, soap, toothbrush and paste, styptic pencil, buttons and pins, file, razor blades, sewing supplies, pencil, playing cards, pipe cleaner and last but not least a fine pair of African golf balls! It's sold by "42" Products Company, 667 Clarence Street, Los Angeles, California.**

means of large safety pins run through the bolt holes, or tie with clothes stops. Then pick up the other end, and away you go! If you want to be high hat, two sticks under the ropes will make the seabag's performance equal to that of any snooty wheelbarrow."

HERE'S AN IDEA that can't very well be illustrated, and can't be of any use to the Service Man—unless—the War Department cares to take notice and put [*Continued on page* 136]

**Below: V-Mail letter from one of our friends overseas has a good suggestion for thirsty lads in dry places.**

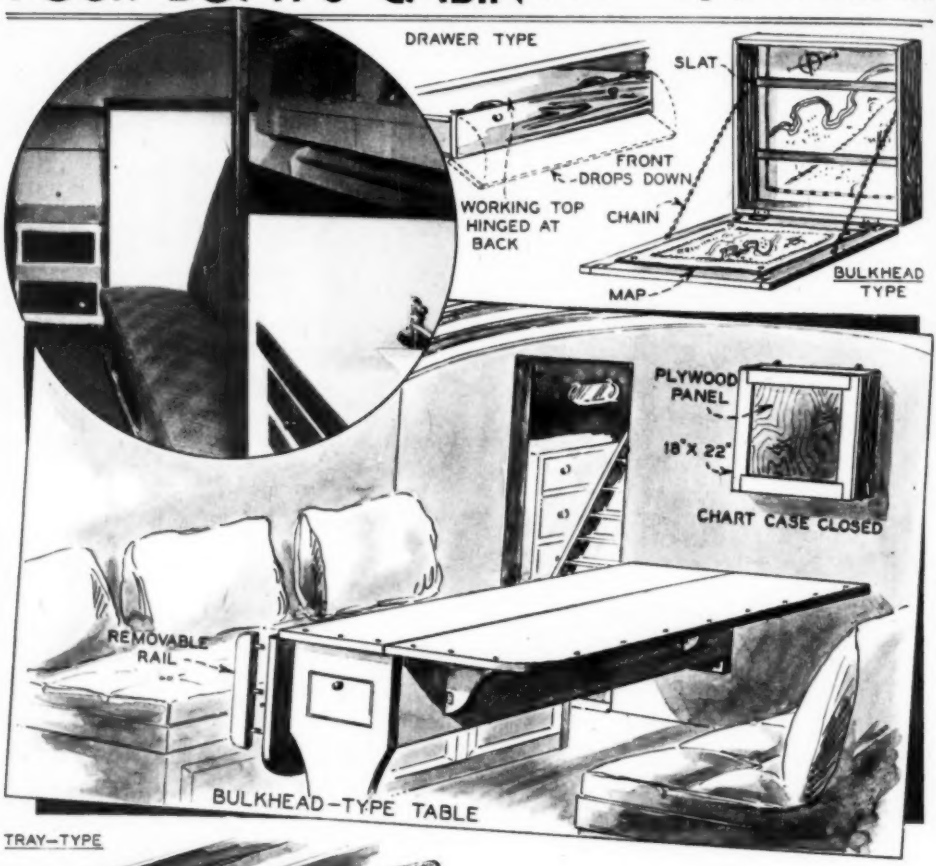
flatirons are forbidden. After G.I.'ing (washing, to you) my tie I lay it soaking wet on a flat scrap of clean lumber. With a G.I. scrub brush I then squeegee the tie flat on the board and let it dry, when it will peel off well-pressed, like a glossy print from a ferrotype tin."

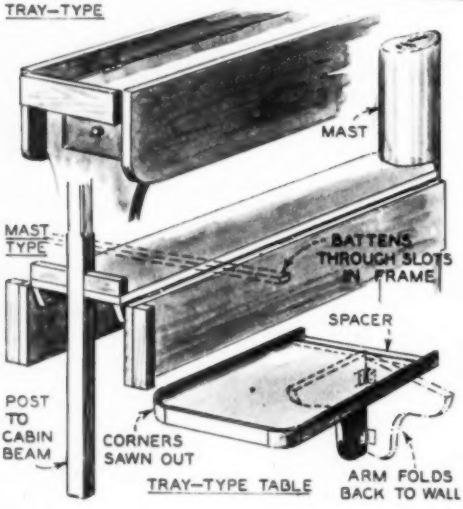
COMES AN ANGLE FROM THE NAVY, in a letter from Donald F. Hickenbottom AOM 3 c. San Francisco, Calif.

"Carrying a loaded seabag any great distance," says Don. "can get mighty tiresome, but if you keep a large caster with a flat base handy it can be done with ease. Simply attach the caster to one end of the bag by

# YOUR BOAT'S CABIN . . .

by J. A. Emmett

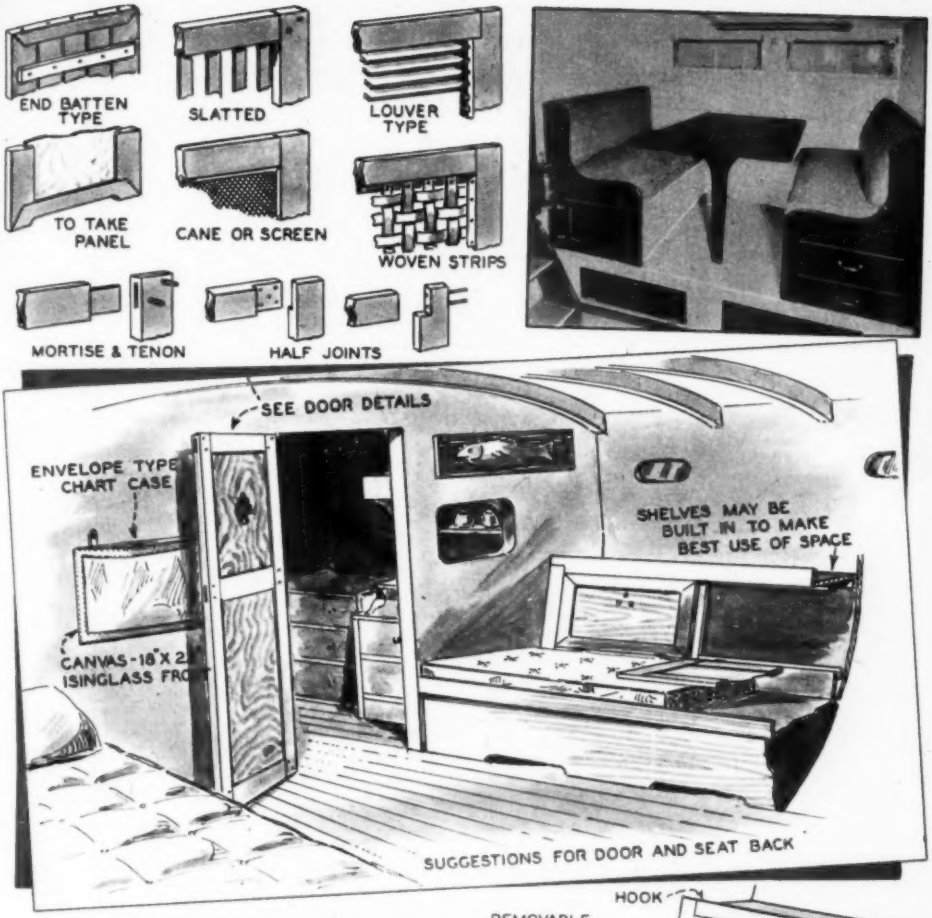



**Making the interior attractive and efficient.**

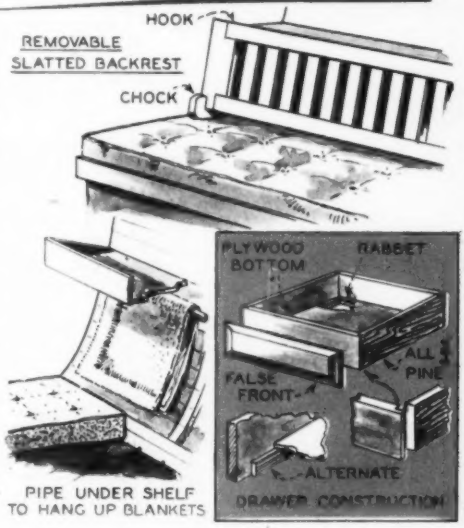
IF YOU are building a cruiser or an auxiliary sailboat, its final cost can be kept down considerably by contracting with your builder to complete the boat except for joiner work inside the cabin. Stock boats can also usually be bought in such partially completed condition for as much as 20 percent below the regular cost while in the used boat market bargains can always be had in boats satisfactory except as to cabin arrangement. In any of these cases completing the boat your-

**Drawings on this page show various types of cabin tables and chart storage ideas. Photo in inset is example of good bulkhead design. Carried only halfway to top makes cabin roomier and better ventilated.**

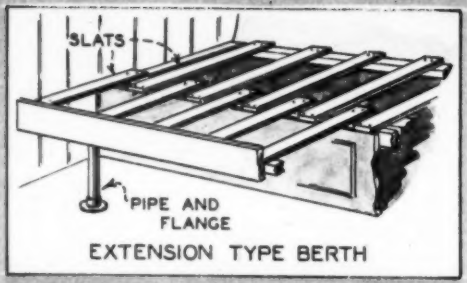



self saves money, as the work represents many hours of expensive labor which would otherwise have to be added to the job.

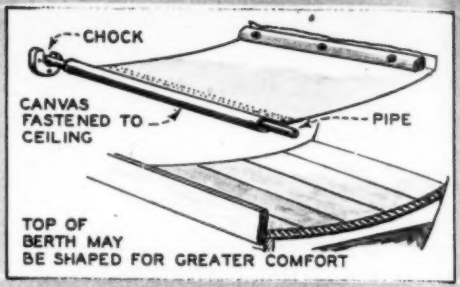
If the boat has been built from reliable plans or is a stock product it is always well to carry out the designer's ideas as to cabin layout. Otherwise any changes made should not be such as to materially affect the trim or balance of the boat. Major weights such as tanks, toilet, and coal stove if any, should be changed only after careful consideration, or preferably with the designer's approval. It is seldom possible to get into the actual hull all the cabin accommodation one is able to plan on paper; the general tendency, especially with




**Here are suggestions for getting most out of berth construction, and details for making doors and drawers. Note how neatly table, drawers and storage compartment worked into cruiser dinette in photo.**



EXTENSION TYPE BERTH




**Above are two types of berths, both easy to make and comfortable. Below: Door frames can be made up rough at mill, then finished carefully by hand.**

**Companionway ladders may be arranged to hide some unsightly piece of necessary mechanical equipment, such as the pump seen under bottom step above.**

**Only way to make steps or ladder really rigid is to rabbet the ends of the treads into side pieces.**

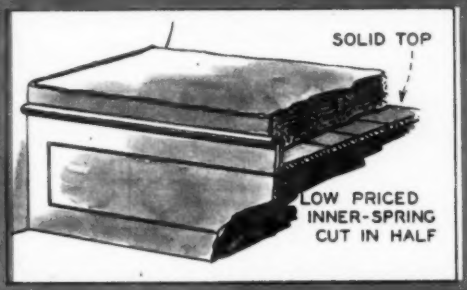
a small boat, is to crowd in too much, making the cabin appear smaller than it actually is. A good idea before actually commencing work is to try to prove ideas planned on paper, tacking up boards and slats to represent bulkheads, fronts of berths, the galley space, toilet room, lockers, and so on.

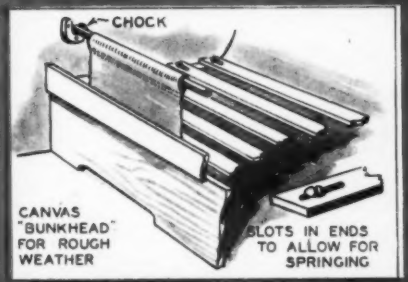
The next thing is to put in the floor beams, or if these are installed to check level of their upper faces. They must not only be in line to have the flooring rest properly atop them but must be true athwartships, or across the boat, so the floor can be used as a base from which to erect other construction. If beams have already been put in by a reputable builder they will probably be found correct, but if they must be fitted and the boat is in the water, help will be required. Their height above the keel at the after and forward ends

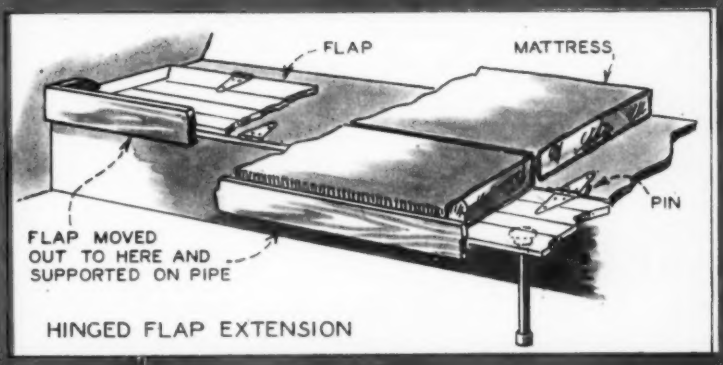
of the cabin space can be determined from the plans.

Commencing with the after end have someone on deck with a spirit level placed on a straight edge extending from rail to rail of the boat. He should shift his weight until the bubble shows in the center of the glass, then call to you below so you can level another straight edge and nail it temporarily to frames at either end of it at the correct height. The beam at the forward end of the cabin is leveled from this, when lines or a straight edge can be stretched between the two to help locate midway beams. This assumes that the cabin floor runs in the usual straight line fore and aft. It must often, however, sweep up gradually forward, not in a straight line but curved to either gain headroom or allow floor width. The best plan in this case is to take a board a foot longer than the length of the cabin floor space and dress the sweep required into its edge, then lay this on edge on the already located end beams, first one side then the other, using it as a guide to get other beams in. The size of beams and their spacing will be shown on the plans. The only departure from this may be if plywood is to be used for flooring (not specified). If a too-thick grade isn't contemplated beam spacings should be halved to give sufficient stiffness to the flooring.

One must now decide whether to build the layout in first so as to have the floor completely removable should such need ever arise, or to set construction on top of the floor, the latter being the easier method and satisfactory if ample hatches are provided to get at the bilge. With the former the fronts of berths, bottoms of bulkheads, lockers, and so on bear on the floor beams and the flooring is finally brought to them. Floor material should be in keeping with the way it is to be finished. Plywood, as mentioned, should be at least ½" thick for the average small boat; its under side painted before laying, and placed on beams spaced at not more than 12" centers. It will not go down as easily as one supposes unless patterns are made for it first, but it will give a fraction of an inch added headroom and provide a surface easily painted and kept clean. Regular dimensioned lumber should not be T. & G. type unless of spruce, redwood, or other wood that will not alternately swell and shrink. Whatever is used should be thoroughly air seasoned, preferably painted on edges [*Continued on page* 140]



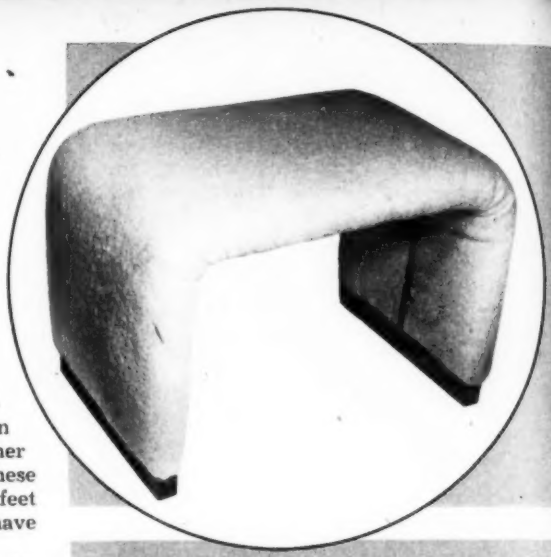




Three more methods of constructing comfortable and attractive berths. The "bunkhead" in the upper right version is easily removed during calm weather but will keep you off the deck (floor to you lubbers) during nasty spells at night. Slats are arranged to give fore-and-aft springing.

# VANITY BENCH

**A modern dressing-table bench will add beauty and charm to a lady's boudoir! Here's a simple, sturdy one.**

by B. Nielson

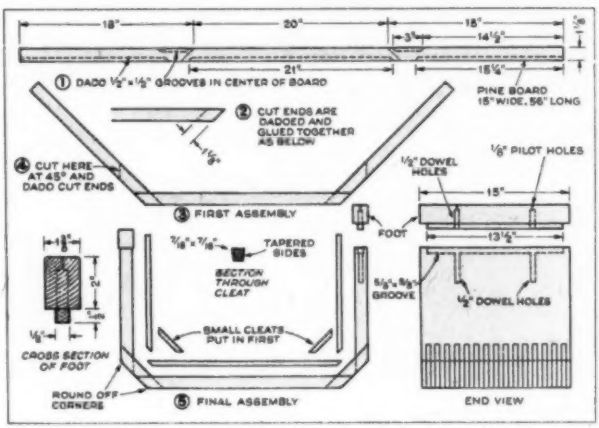


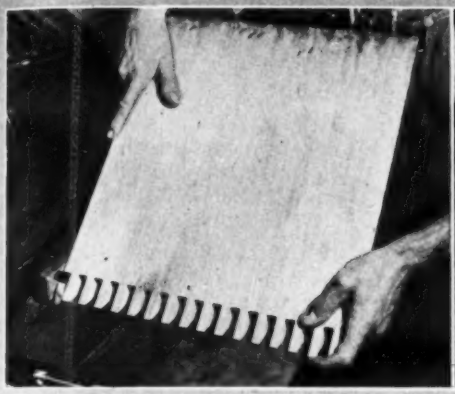
THIS vanity bench combines exceptional strength with ultra-modern design. Some of its features are rather unique. The model described on these pages was made from white pine with feet of walnut, although maple feet could have been used if desired.

A plank 56″ x 15″ x 1⅛″ will make the top and sides. First cut a groove ½″ x ½″ lengthwise through the center of the board, and then cut into three pieces according to the dimensions given. Make dado cuts in the ends; the depth and width of these cuts are shown in the drawings. They can be made easily and uniformly by moving the saw fence exactly 1″ for each cut. The three parts are glued together for the first assembly, and when the glue has dried, the end pieces are cut off as indicated and a series of dadoes are made for the second and final assembly. Before this last assembly, cut a groove ⅝″ x ⅝″ in the end of each side piece and drill ½″ dowel holes for the bench feet. All edges of the bench are rounded slightly.

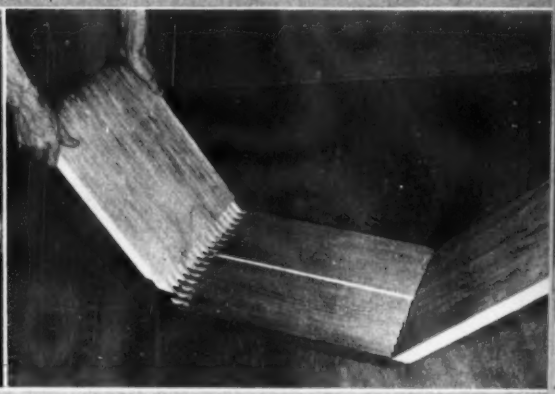
Cut off ends as shown and dado once more.

Photos show the simple method used in upholstering. Ordinary cotton batting will serve as padding, and the material for covering will depend entirely upon your preference. Tacks will hold the covering, and to finish, wood cleats to match the feet are fitted into the grooves previously made in the center of the bench pieces and are held with small brads. Cleats have tapered sides, as shown. Fasten small ones first. Cleats and feet are finished with shellac, rubbed down and waxed. The latter are held to dowels by means of nails through ⅛″ pilot holes drilled in them. These details of construction are indicated in the diagram at the right.

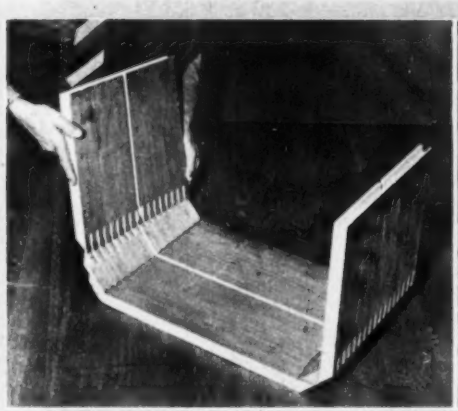




First, dado cuts are made in end pieces.

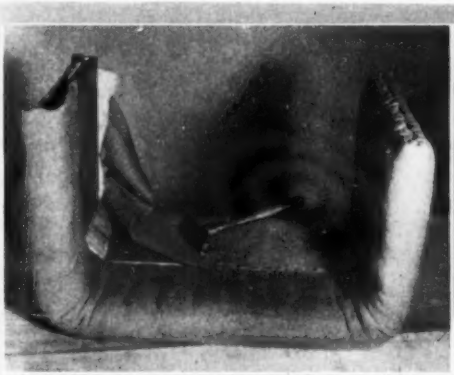


Glue the end pieces to third dadoed section.

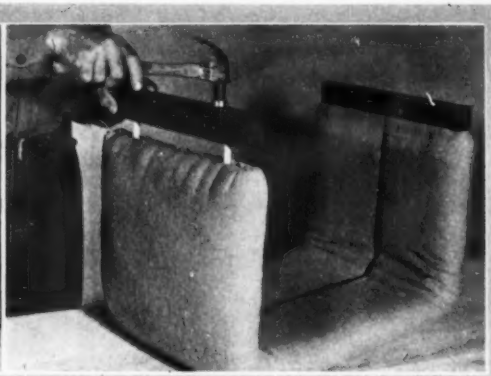


These ends then are fastened to bench seat.

Padding and upholstery are tacked in position.



Upholstering is almost complete above.



Use pegs and glue to attach feet to bench ends.

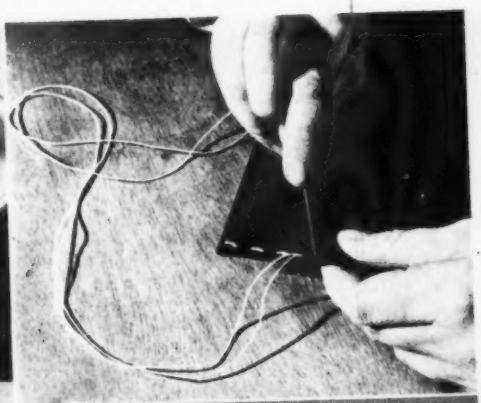
# Book Cover

THIS project is the second on the subject of leather-working to appear in MECHANIX ILLUSTRATED. In the January issue there appeared a simple but serviceable wallet, the tooling procedure illustrated, step by step, by pictures. Here is an equally attractive book cover to test your skill.

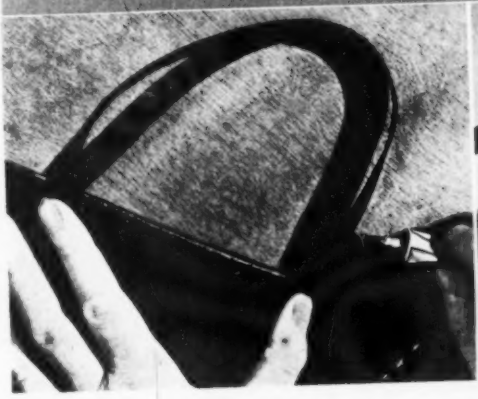
**Leather must be slightly wider than book and 5½" longer to allow for flaps for bookends.**

**First cut paper pattern to required size, place on leather and cut out. Fold narrow sides 2¾" from edge and fasten with glue at edges. These are flaps in which cover ends are inserted.**

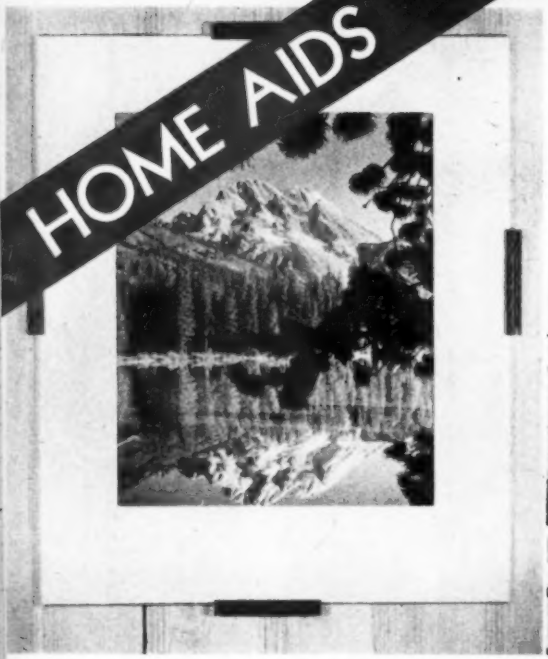
With straightedge draw a line around the outside of cover 3/16" from edge. With a fork mark the spots to be perforated as shown.



Make holes with puncher and hammer. With doubled thread sew sides lengthwise, pushing needle in one hole and out the next. Handles are 13/16" straps, glued and sewn to cover.

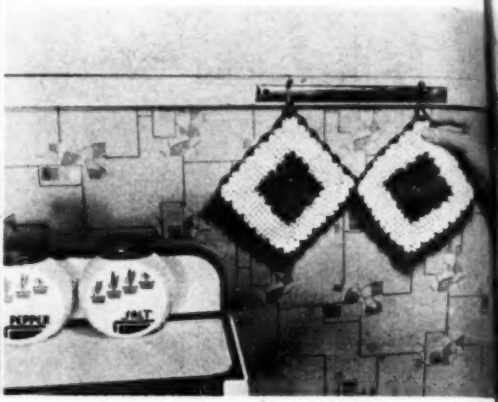


# HOME AIDS



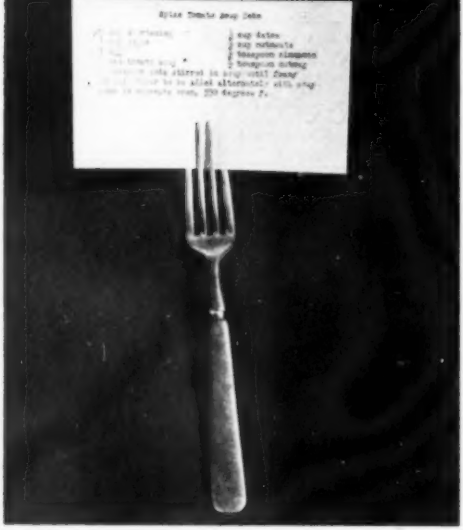
## ← Framing Pictures

FRAMING large pictures is usually an expensive job, but here's a method both simple and cheap. Mount each picture on cardboard, cover with glass, and fasten both to the wall with screws through short strips of molding cut from an old frame.



## Fork Holds Recipe Card

TO KEEP your recipe cards clean and handy while you're concentrating on the daily menu, try inserting them between the prongs of a fork as shown. The fork will hold each card at a convenient angle for reading and will keep it raised from the table top.



## Rack For Pot Holders

THE metal strip with its two sturdy clamping rings can be removed from a loose-leaf notebook cover and used as a hanging rack for pot holders. Attach to the wall or molding with screws inserted through the holes already in strip. Paint to match kitchen.

## Pictures On Candles

PARTY candles can be made more amusing and attractive by transferring newspaper pictures of comic characters to them. Hold the picture around the candle and move a lighted match over it until the wax melts. Remove paper when wax has hardened.

## Cleaning Upholstery

IF NO vacuum cleaner is available when cleaning upholstered furniture, place a damp cloth over the fabric and tap it gently all over with a stick. The dust will be loosened and will come to the surface where it will be caught by the cloth.

## When Baking Potatoes

THE long cooking time required for baking potatoes can be cut almost in half if a hole is made through the center of each potato as shown. Use an apple corer to make the hole quickly and cleanly. When serving, place butter in the center to melt.

## Cover For Grinder

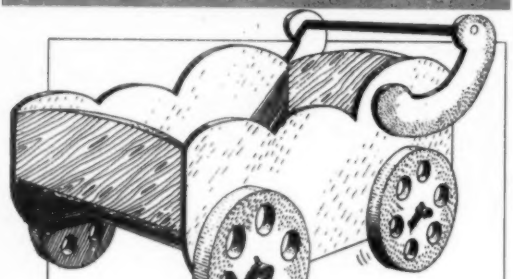
THE next time you grind dry bread or crackers, slip an oiled silk bowl cover over the head of the grinder. It will keep the crumbs from flying out on the table and floor. If you haven't one of these covers, you can get a set at the local hardware store.

## Pitcher Prevents Drip

AT THE local hardware store you can pick up also this drip-cut pitcher which will serve your cream efficiently and without waste. The pitcher with its cream can be stored in the refrigerator when not in use. Lid protects contents.

# TOYS FROM THE WORKSHOP . .

Attractive cradle and buggy for little girls' dolls are easy to make. Details are given in the sketch below.

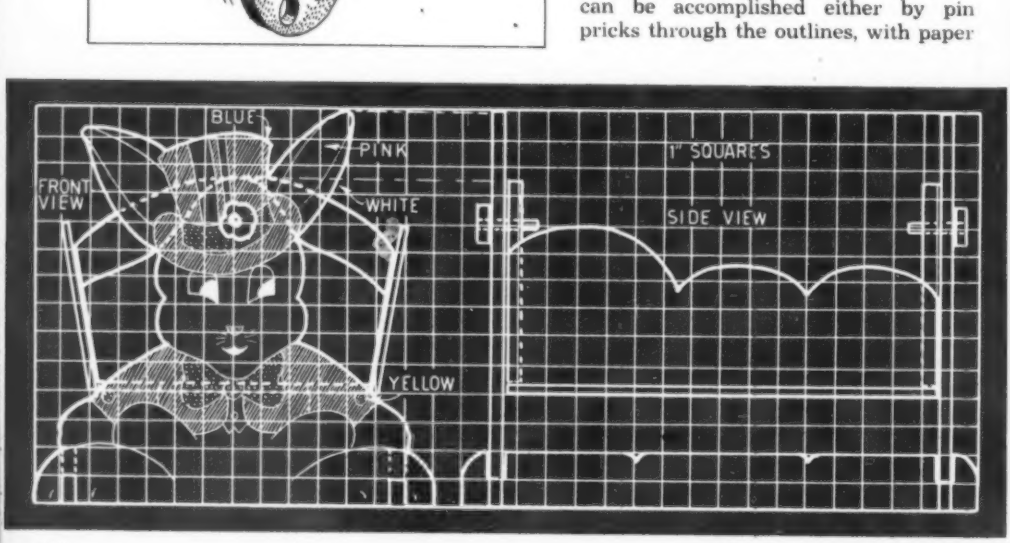


by Roberta Fairall

IF YOU have kids in the family of "toy" age, your workshop can be a constant source of delight for them, and you'll get almost as much kick out of making simple playthings for them as they will in receiving the toys. In addition, you'll be providing the children with something you might not be able to buy at the present time, for war shortages have hit the toy market hard. The financial saving is, of course, obvious; shop scraps and odds and ends of plywood or lumber that might otherwise be thrown out or burned are your construction materials.

Plywood or thin solid stock is used for this novel doll cradle, which swings between two amusing little bunnies, and its companion piece, a small doll buggy. The pair make up a toy set that any little girl will love.

To make the cradle, draw the bunny on wrapping or tracing paper and transfer the drawing in duplicate to half-inch stock, preferably plywood. The design of the bunny is shown laid out in squares of convenient size for easy copying. Transfer of your drawing to the wood can be accomplished either by pin pricks through the outlines, with paper

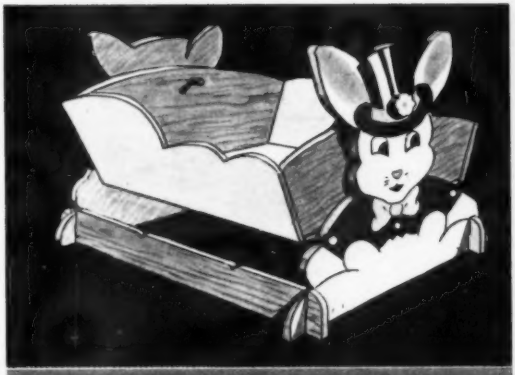


laid flat on wood, or by rubbing the reverse side of the sketch with heavy lead pencil. Lines can then be traced to the wood much in the manner of a carbon copy.

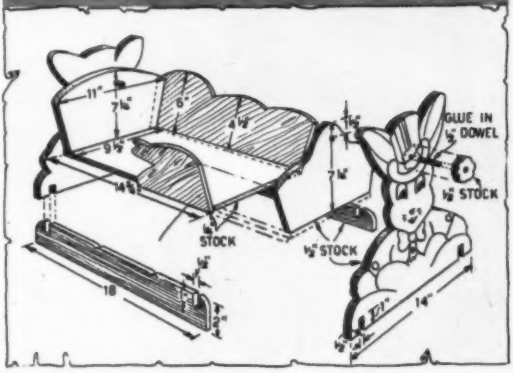
Cut the bunnies out on the jigsaw, or, if you have no power tool available for the purpose, a hand coping saw will do just as well even though it may be a little slower. Notch the feet and drill a half-inch hole through the hats. Next, jigsaw the flowers for the hats from similar stock. Drill holes through the center of these, also. Glue a tight-fitting dowel 2" long in each hole, then slip the dowel-flower assembly through the holes in the hats and glue in place.

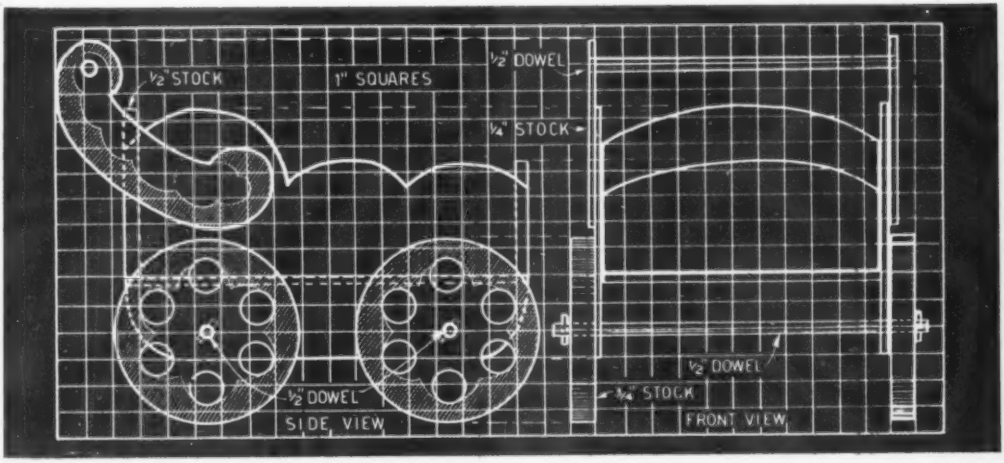
Cradle ends are also sawn from half-inch stock, and a ⅝" hole drilled in the middle of each. Center these holes about one half-inch from the tops. Cut the two sides and the bottom from quarter-inch material and nail together. Swing the cradle between the bunnies on the dowels glued in these sections for the purpose.

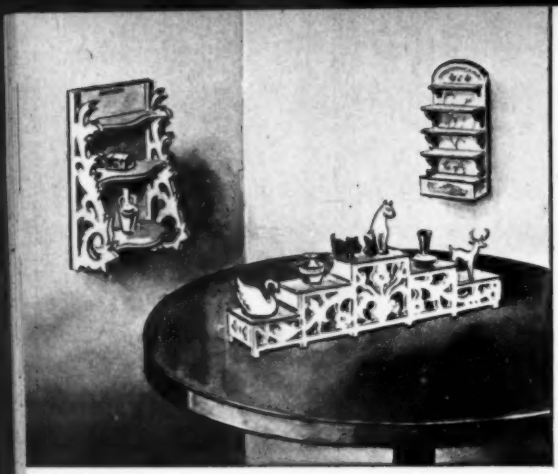
Two cross-braces made from thin wood are notched at each end, slipped into receiving notches in the bunnies' feet, and glued [*Continued on page* 134]



**Above: The finished bunny cradle. Rocking assembly operates on dowel sticks, as seen in lower perspective.**



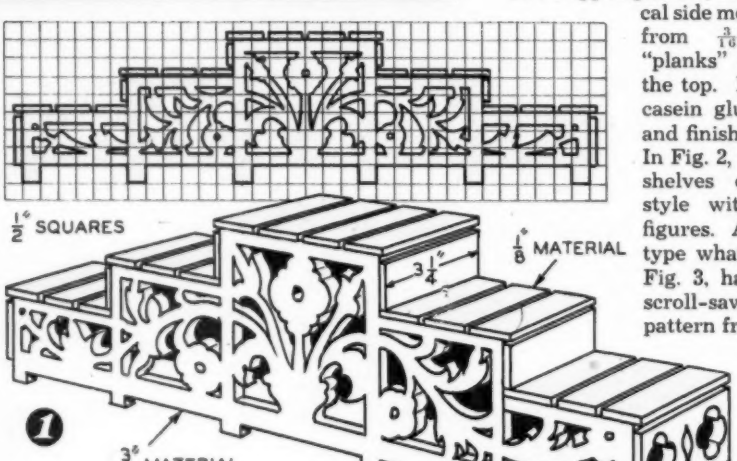



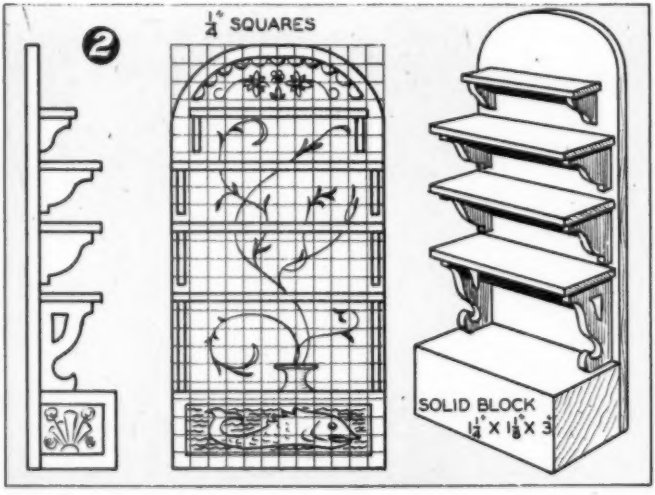


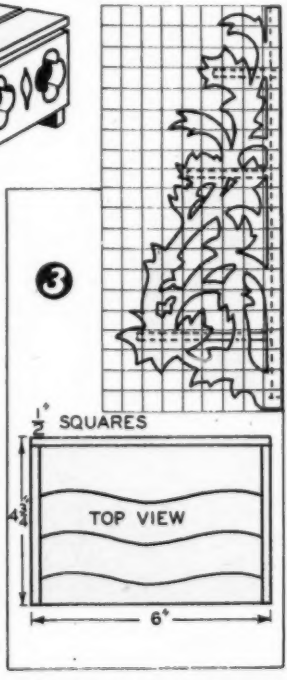
# MINIATURE WHATNOTS

WITH the present interest in miniatures of all kinds, whatnots on which to display them are very much in order. Here are two designs in scroll-sawed filigree; and a third, of more simple construction. The latter is a Mexican importation.

The stepped pattern, Fig. 1, has two identical side members scroll-sawed from $\frac{3}{16}$" material, with "planks" of ⅛" wood across the top. It is assembled with casein glue and small brads, and finished in natural wood. In Fig. 2, is a set of miniature shelves decorated in peon style with crudely painted figures. A conventional wall-type whatnot is presented in Fig. 3, having side members scroll-sawed in maple-leaf pattern from ⅛" material.



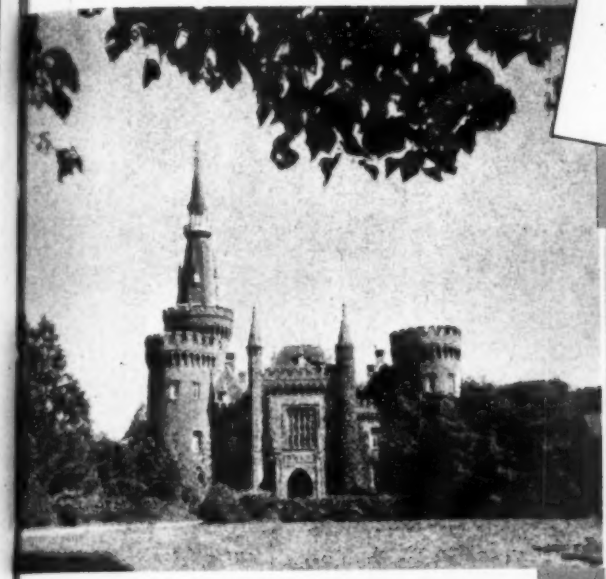



# BROMOIL EFFECTS IN ENLARGING

**Bromoil prints are projects for the advanced amateur, but anyone can use this method to get similar results.**

by Roy Lester



Enlargement is made from paper negative.

ALL of us, at one time or another, have seen and admired beautiful prints made by the bromoil process. Perhaps we've even thought of making some ourselves, but have balked at the complicated process involved.

There's a simpler method of producing print effects, very similar to those made by the bromoil process, however, and it requires nothing extra in the way of material than is found in the average amateur's darkroom. The effects, which are graphically illustrated in the accompanying photos, are produced as follows:

Make a contact print from the original negative selected for the process. After fixing and drying this print, place it in a print frame, face to face with a sheet of contact paper, and from it make another contact print. This result when developed will be a paper negative with a slightly mottled texture caused by the paper grain of the print.

The next step is to make an enlargement from this paper negative, but to do this, it should be made more translucent by oiling its back with glycerine, lemon oil, or any other suitable oil. Due to the thickness and poorer light transmitting quality of the paper negative, a considerably [*Continued on page* 134]

Paper negative is made translucent with oil.

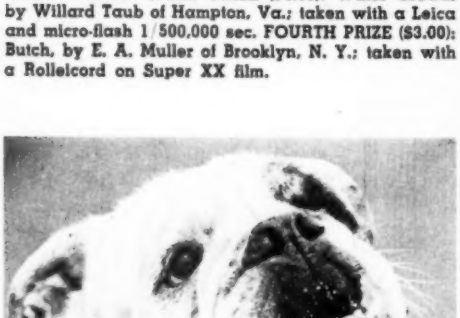
# PHOTO CONTEST

1st PRIZE

2nd PRIZE

3rd PRIZE

**FIRST PRIZE ($10.00): Shore Leave, by Dr. I. K. Moorhouse of Beaumont, Texas; taken with a Speed Graphic. SECOND PRIZE ($5.00): Wishful Skipper, by Harvey Colpe of Alexandria, Va.; taken with a Voigtlander Brilliant. THIRD PRIZE ($4.00): Water Crown, by Willard Taub of Hampton, Va.; taken with a Leica and micro-flash 1/500,000 sec. FOURTH PRIZE ($3.00): Butch, by E. A. Muller of Brooklyn, N. Y.; taken with a Rolleicord on Super XX film.**



4th PRIZE

Submit contest prints unmounted—no larger than 8x10 inches. With each print list camera, film, lens opening and shutter speed, illumination and developer. Write your NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. ENCLOSE POSTAGE for the return of unused prints. Published prints cannot be returned. Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, N. Y.

# Trade-Mark YOUR PRINTS

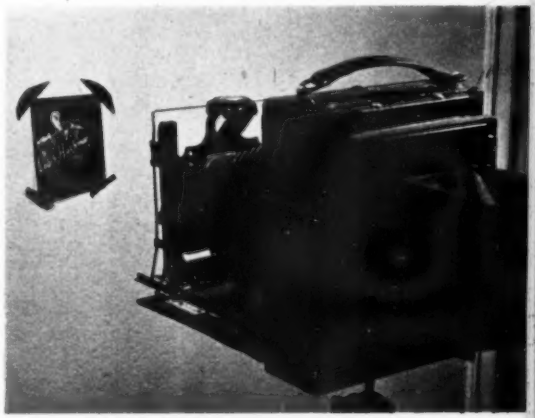
IF YOU like the prints you make, why not add a little personal touch to them by giving them your stamp of approval in the form of a photographic trade-mark? Your own individual trade-mark, personally conceived, executed, and added to the corner or margin of your masterpiece, will serve as a decorative signature, attesting to the skill and effort you put into the production of your prints.

Photographic trade-mark stampers can be made in several ways, the simplest being a design, lettered in black India ink, on a sheet of clear celluloid. This celluloid design is then laid over the corner of the bromide paper on the enlarger easel and left there during the exposure of the enlargement as shown on page 124. Upon development, it will appear on the finished print in white.

Even more interesting patterns can be made photographically by either lettering your signature over the face of a suitable photo and copying the finished product to the desired scale, or making novel table-top designs including as part of the design your name, laid out in cut-out letters, bent wire or solder. For table-top setups, interesting ideas also can be composed around photographic equipment and paraphernalia such as flashbulbs, lenses, film spools, cameras, etc. In shooting these trade-marks, make sure that they are reduced to scale on the negative so that they will be the right size for contact printing on your photos.

The developed negative then is cut down and cemented to a cardboard frame attached to the business end of a penlite, thus forming a stamper that stamps with light instead of ink.

To make the frame for the penlite, first



**Here's an unusual signature: sign your own pic, copy and print in the margin of a large photo.**

**These two trade-marks are simple. In the photo above, celluloid name plate is placed in corner of paper before enlarging. Penlite is used at upper right. The photo below shows how penlite is constructed: diffusing paper on light and negative on box end. Use oval tube if desired.**

fold a rectangular tube of cardboard, its dimensions being exactly that of the size of the trade-mark. Circular and oval tubes can also be made if the trade-mark is to fit into any of those particular shapes. To one end of this tube cement the trade-mark negative, emulsion side out, after cutting it down to the right size. Use cellulose cement lightly around the rim of the tube.

Since the trade-mark will be contact-printed on the bromide paper, which is extremely fast under the circumstances, the light of the penlite should be subdued and diffused to prevent over-exposure. Do this by rolling a cardboard tube snugly over the penlite's end and covering the end of this tube with several thicknesses of tracing paper. The trade-mark tube can be made to fit snugly over this diffuser tube.

In use, the trade-mark is light-stamped on the print by pressing the film end flush against the bromide paper on the enlarger easel and snapping the penlite on and off. Make a few preliminary test exposures on scraps of bromide paper to determine the exact exposure time required, and always give that exposure. Print your trade-mark in that portion of the bromide enlargement where the lightest portion of the photograph will be. This will be the darkest portion of the projected negative on the

Trade-mark made with penlite will look like this.

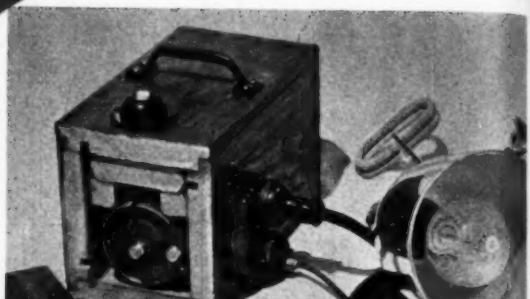
easel. Narrow trade-marks can also be printed on the white margins of the print instead of over the photo itself.

These trade-marks are fun to work out and full play can be given to your imagination. If you want to letter your design on a photo, you can use either a portrait of yourself, or pictures of cameras, lenses, or other photographic equipment. Use white paper color and a fine camel's hair brush for your lettering.

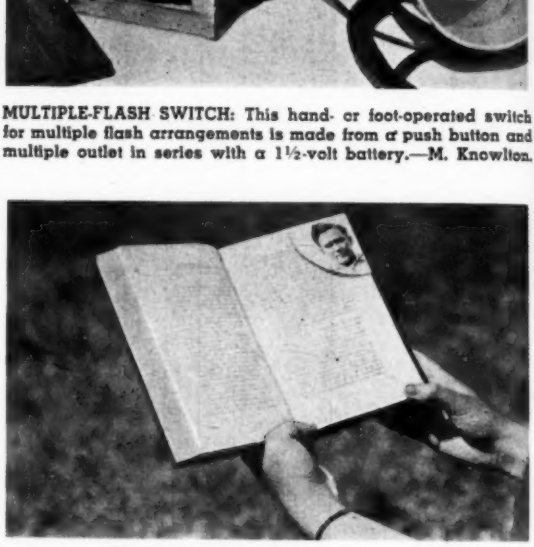
This one was made by shooting simple table-top setup.

# PHOTO KINKS

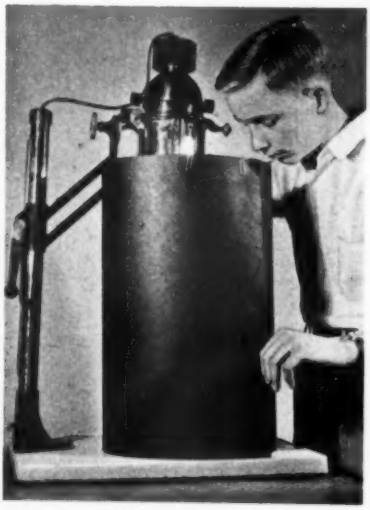
**STOPPER FOR BOTTLES:** A stopper of the type used for sinks and bathtubs will serve also as an excellent cork for large bottles storing solutions. Stopper can be cut to size with a knife. It will fit snugly and can be removed by yanking chain.—K. Murray.



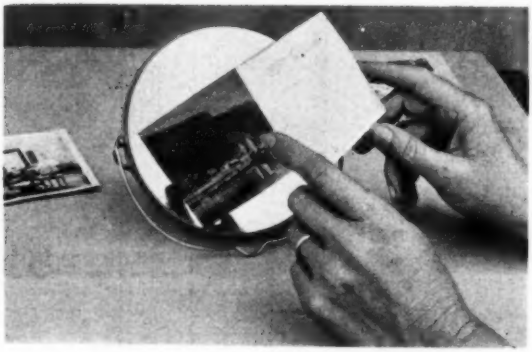
**MULTIPLE-FLASH SWITCH:** This hand- or foot-operated switch for multiple flash arrangements is made from a push button and multiple outlet in series with a 1½-volt battery.—M. Knowlton.



**PHOTOGRAPHIC BOOKMARK:** Cut a photograph in a semi-circle, from the lower right-hand corner upward to the upper right-hand corner. Fold the ends back and glue.—H. Wallin.



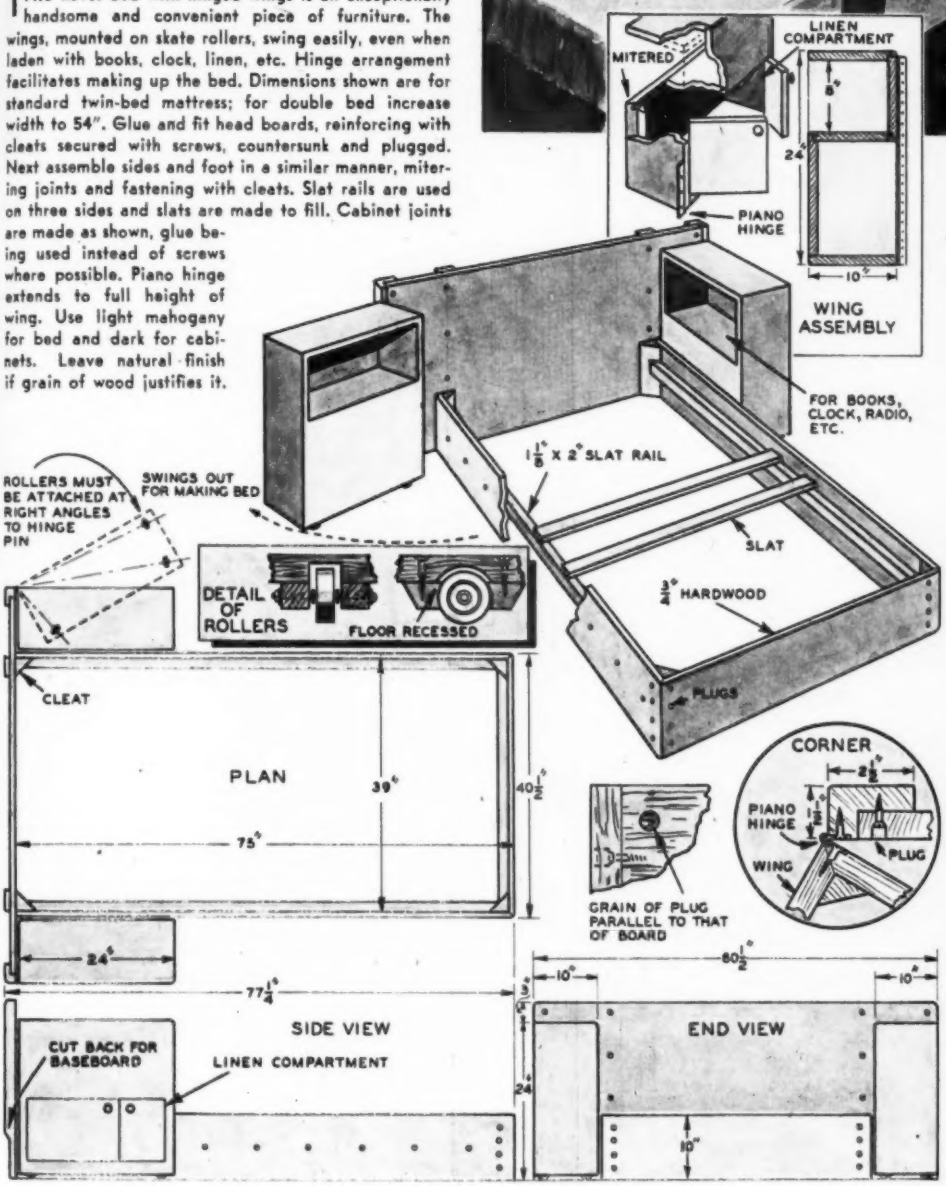
**SHIELD FOR ENLARGER:** If your enlarger is located near surfaces which reflect light, your paper may be fogged by stray beams from the lighting unit. To prevent this possibility, place a shield of cardboard around easel and enlarger.—K. Murray.



**ENLARGEMENT PRE-VIEWER:** If you wish to see how an enlargement of your favorite print will look, hold it in front of the magnifying surface of a double hand mirror.—W. Wheatley.

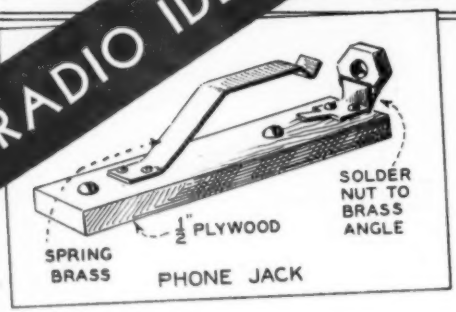
# Swing-Wing Bedstead

THIS novel bed with hinged wings is an exceptionally handsome and convenient piece of furniture. The wings, mounted on skate rollers, swing easily, even when laden with books, clock, linen, etc. Hinge arrangement facilitates making up the bed. Dimensions shown are for standard twin-bed mattress; for double bed increase width to 54". Glue and fit head boards, reinforcing with cleats secured with screws, countersunk and plugged. Next assemble sides and foot in a similar manner, mitering joints and fastening with cleats. Slat rails are used on three sides and slats are made to fill. Cabinet joints are made as shown, glue being used instead of screws where possible. Piano hinge extends to full height of wing. Use light mahogany for bed and dark for cabinets. Leave natural finish if grain of wood justifies it.



RADIO IDEAS

# How to Make Simple Radio Parts

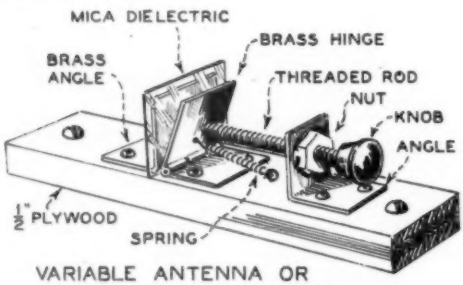


PHONE JACK

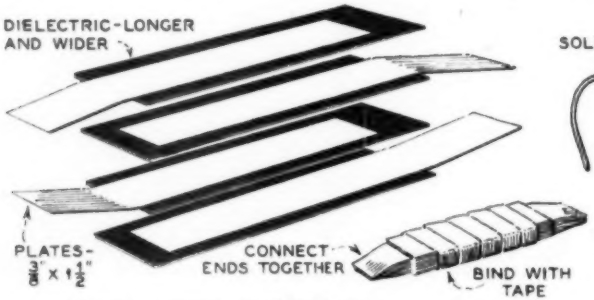
BY APPROPRIATING a few odds and ends from old receivers and from the scrap of the work bench, many serviceable radio parts can be constructed and assembled that will help fill the gap in these days of "hard to get" radio materials. A dozen such home-made units are shown herein. Probably many others can be evolved by studying these diagrams.

If a phone jack is wanted, a simple open circuit jack can be constructed as shown. The base is a piece of ½" plywood. On one end is mounted a strip of spring brass with a connecting tab at the rear. A nut with hole large enough for the entrance of the plug is then soldered to a small brass angle that ends in a second connecting tab. Then the base is attached to the chassis with two screws or bolts. Distance between spring and nut must be adjusted to make effective contact with the plug terminals.

A good RF choke can be made by winding a 2½" piece of ¼" wood dowel with four separate scramble-wound units connected in

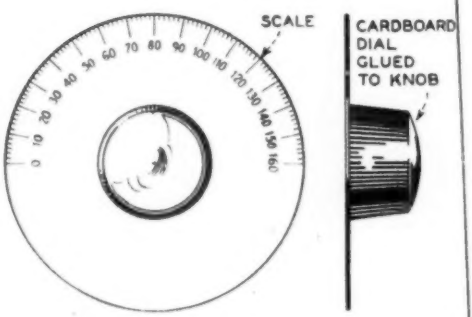


VARIABLE ANTENNA OR NEUTRALIZING CONDENSER

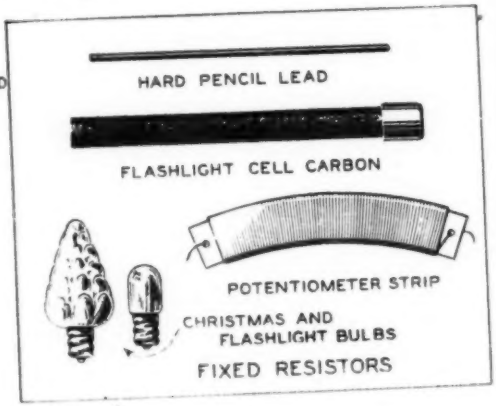


SIMPLE FIXED CONDENSER

SMALL R·F· CHOKE



DIAL SCALE FOR KNOB



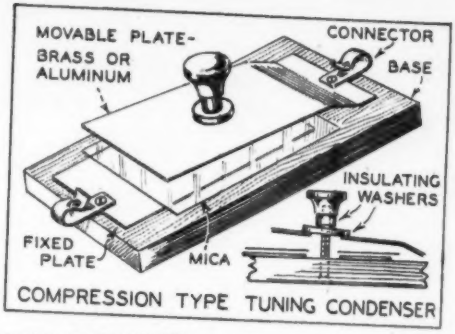
FIXED RESISTORS

series. Use No. 30 DCC wire and separate windings by about ¼". Drive two soft wire pins in the ends of the dowel and connect the ends of the two outside windings to them with solder. Then paint the windings with Duco or other household cement.

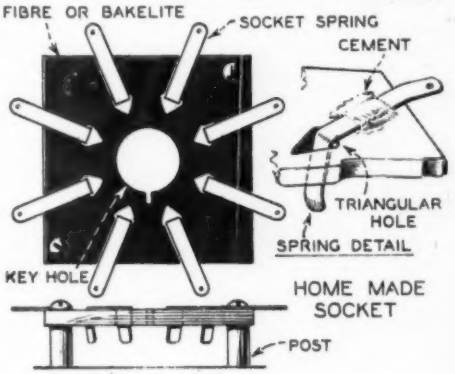
A nice little variable antenna, padding or neutralizing condenser can be made from spare parts. Fashion an angle of brass with the upright ¾" square. Cement a slightly larger square of mica to the upright face and then fasten a ¾" square brass hinge to the base close to the first upright. Solder tab at the base of the hinge. Solder a third angle to a suitable nut into which is screwed a threaded rod ending in a knob. When screwed nearly all the way in, this rod should push the hinge upright up against the mica. A spring fastened to a screw-eye pulls the hinge back away from the mica when the rod is unthreaded, thus changing the capacity. Half-inch plywood forms the base.

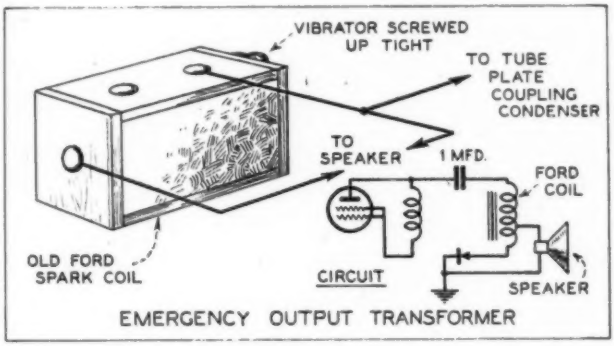
A serviceable scaled dial can be made by cementing a suitably large disk of white cardboard to the flat inside face of a knob, as shown. Scribe the disk with markings laid off with compass and protractor, inking them into it.

Fixed resistors of [*Continued on page* 142]

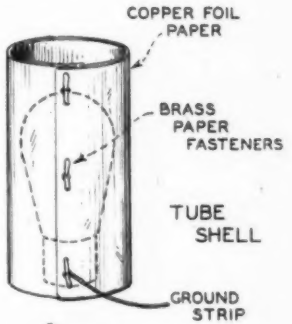


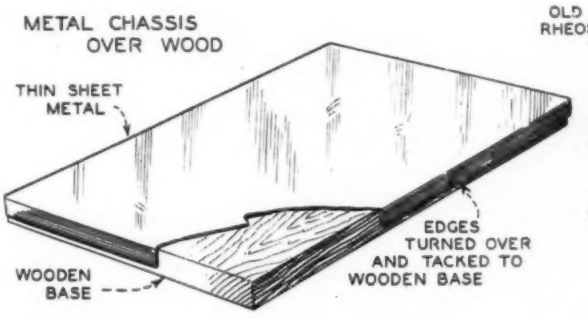
COMPRESSION TYPE TUNING CONDENSER

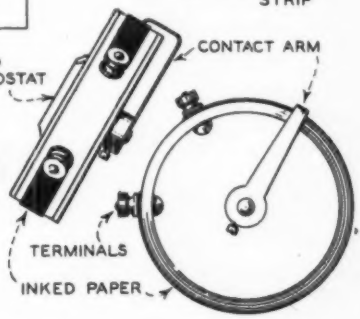


EMERGENCY OUTPUT TRANSFORMER



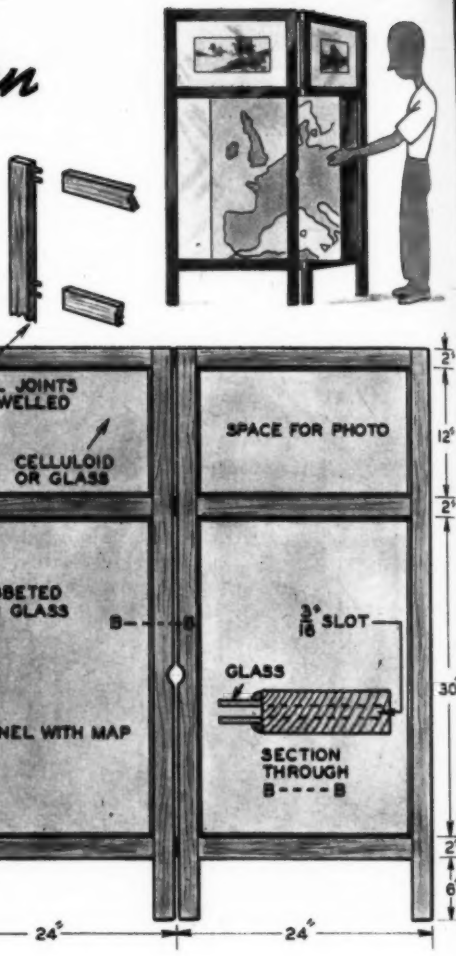



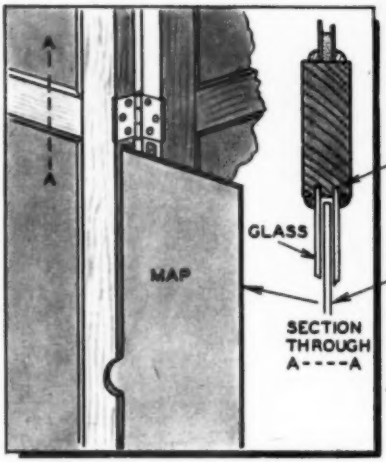



VARIABLE GRID-LEAK

# War-Map Screen

THIS simple screen serves a double purpose: it can conceal a doorway or unattractive object in the room, and at the same time it is a decorative frame for pictures or war maps which can be replaced from time to time. Assemble the frame with ¼" dowels and glue, the two units being hinged as shown. Maps and pictures, mounted on heavy cardboard, slide between glass in the lower panels and may be mounted permanently in the upper panels. Maps slide from their frames through openings at the hinge side. Finish with a dark stain and wax.




## INVISIBLE WRITING with SECRET INKS

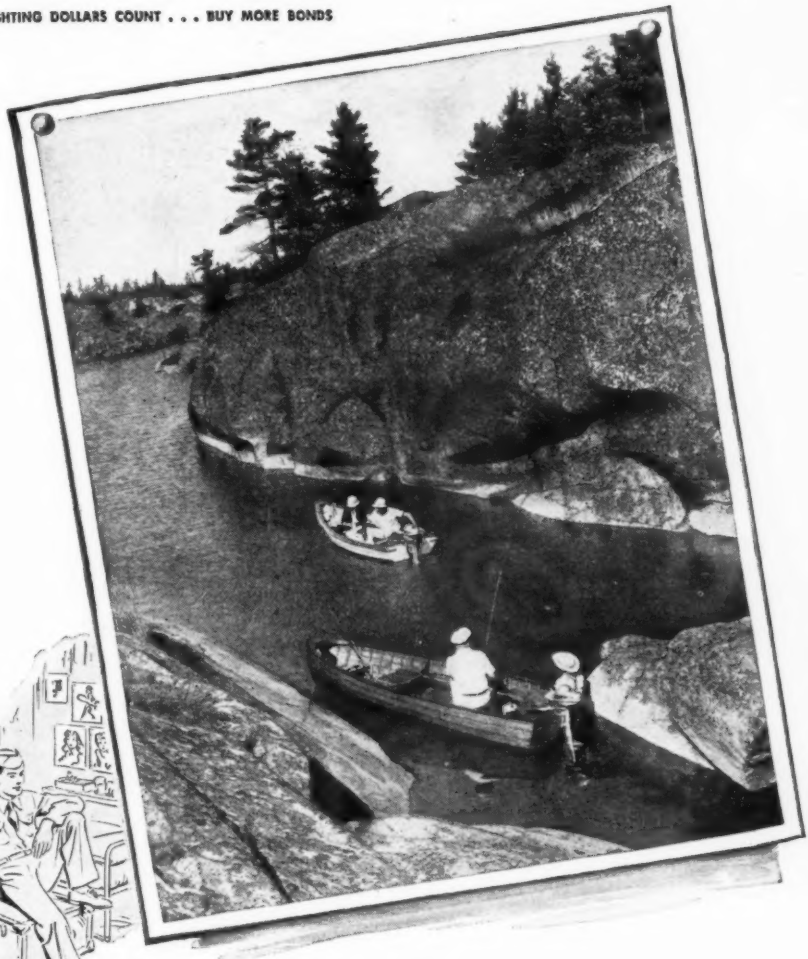
THE discovery and use of secret inks is a fascinating and inexpensive hobby. Invisible, or sympathetic inks as they are known, are widely used, particularly in wartime. Although foreign agents and spies use highly developed invisible inks that require unusual methods to bring out the characters, there are many simple, secret inks that you can make right in your own home. Of these, orange juice, lemon juice, milk and buttermilk are a few. These inks can be brought out by the application of heat. A flat iron or lighted candle do very well, or the paper can be held close to a warm electric bulb.

When sending a message with invisible ink you can write on any unsuspicious part of the letter or envelope. Beneath the flap of an envelope is a good place, and along the margin of the letter is also a good spot for the secret message.

Try other fruit juices and liquids. Make your own concoctions. Soon you will have a score or more of invisible inks that you will have had the fun of discovering. Keep experimenting. Onion and cabbage juice work well.

All invisible inks will show on glazed paper; therefore, unglazed paper should be used. Also, the ordinary pen is too hard and sharp and might dig into the paper: use a well-rounded or ball point. Having experimented with the simpler [*Continued on page* 136]

★ ONLY FIGHTING DOLLARS COUNT . . . BUY MORE BONDS



# "Pin-ups"... we all have them!

Lovely Pin-up girls a-plenty... but barrack walls can't hold all the pictures a soldier sees. Beyond are other scenes... perhaps of that winding inlet, blue and silent... the big grey rocks topped with pines against the sky... the bass that smashed and fought like fury... *"Man, oh man . . . when I get back!"*

In fox-hole or gun turret... or at bench, machine or desk... we all have our "pin-ups". Things we've enjoyed before and that we're going to enjoy again. Mental pictures that to each of us satisfyingly symbolizes the freedom that America is fighting and working for.

The fine motors that now go, and which for more than two years have been flowing from the Evinrude plant to all branches of our fighting forces, are designed to speed the day of Victory... when *pin-ups* can become *realities.*

**EVINRUDE MOTORS,** *Milwaukee, Wisconsin*
*Evinrude Motors of Canada, Peterbore, Canada*

**EVINRUDE**
**OUTBOARD MOTORS**

## Lathe Tailstock Turret

[*Continued from page* 88]

to the end of the elliptical pin is actuated by striking the end of a bolt mounted on the tailstock body, and a hook-shaped flat spring fastened beneath it, as shown.

The photographs illustrate clearly the rack-and-pinion arrangements for moving the turret back and forth. In the original, a ram was constructed by machining a bar of steel to fit the tailstock casting in place of the regular spindle, the keyway being milled with the aid of a tool-post grinder while the work was anchored between centers. The rack is $\frac{5}{8}$" square and the pinion shaft was machined from $\frac{3}{4}$" steel. The method of mounting makes use of two 1" square bars bolted to the tailstock casting, the rear one being steadied by a diagonal brace. The outer end of the ram was never machined off as originally planned, but was equipped with a rubber crutch tip after two or three encounters between it and some elbows! A block may be clamped to the rack so it acts as a stop by striking one of the uprights. A scale on top of the rack and pointer attached to the rear upright are useful in gauging drilling operations that are not numerous enough to warrant the setting of a stop.

When the turnstile, made from steel rods equipped with automobile gear-shift knobs, is turned to move the ram all the way to the right, the lever connected to the elliptical pin between the locking plates strikes a pin (bolt) projecting from the tail-stock body, causing the tension on the clamping bolt to ease. After the tension is relieved, the index-pin lever strikes another projecting bolt, and the index pin is withdrawn enough to clear the turret sockets. The lathe operator then rotates the turret by hand to the next tool position, which he locates approximately by feeling the "click" of the steel ball in one of the sockets in the turret bottom. Then as he moves the ram toward the headstock, the index pin enters the socket opposite it, pulling the turret into position if it is not already so. Next the hooked spring beneath the locking lever pulls that lever back, expanding the locking plates and drawing the bolt tight. The turret is then locked in place until the ram is moved all the way to the right again.

It was found necessary to file a small groove from the hole in which the index-pin bushing fits to the edge of the base casting, on the surface in contact with the turret bottom, to permit air to escape when the pin is forced home. Also, it would be a good idea to groove each tool hole or drill a small hole from it to some point on the outside surface of the turret, to permit air to escape or enter when a tool is installed or removed. The clamping bolt has an oil hole drilled axially from the head end for about 2¼", and lateral holes drilled to conduct oil to the holes in the two castings. The bolt is free to turn in either casting.

## Willie Woodpecker

[*Continued from page* 91]

as shown in figure 3. No attempt should be made to form the bill, since that is made up of the metal rod, figure 12, and plastic wood. Round the end of the head slightly inside so that it will fit down over the upper part of the body, and cut a square hole, ⅛"x½", partly through the lower part of the head to fit armature bar.

Lay out and drill a piece of No. 20 gauge sheet steel as shown at figure 5. Bend the sides along the broken lines to form a right-angle with the back.

Drill the centers of the ½" iron rod to a depth of ⅜" with a No. 33 drill, and tap the holes for 6-32 threads, as shown at figure 9. Place a fibre washer on each end of the iron rods and wind 10 feet of No. 22 enameled wire on each, leaving about 3" of wire protruding for connections. Secure the magnet coils to the back of the sheet steel frame with short 6-32 machine screws, which are to be removed later when the vibrator unit is secured to the wood body. Connect coils so that the outer face of one magnet core will form a north pole and the other a south pole. Determine with compass.

The delayed action contact is made up of the brass tubing, figure 14, and the brass plunger, figure 15. Cut away a section of the brass tubing as shown and solder a short piece of $\frac{3}{16}$" round brass rod in the opposite end. Drill and tap the closed end for a 6-32 thread. Cut away a section of the $\frac{3}{16}$" round brass rod as shown and solder a silver contact to the upper end of the rod. Insert the brass rod in the brass tubing and secure the brass tubing to the vibrator frame, figure 5, with a R. H. machine screw. When attaching the delayed contact unit to the frame, the extended piece on the armature, figure 8, should project into the cut-away sections of the brass tubing and rod before the tubing is secured into place.

Wind the piano wire into a coiled spring ¼" in diameter and 1" long, as shown at figure 11. Solder one end of the spring to the vibrator base so that it will be directly under the end of the armature bar. Solder a piece of flexible wire to the plunger bar, just below the silver contact. Connect the other end of the flexible wire to one of the coil leads.

Remove the short machine screws which held the coils in place temporarily and secure the vibrator unit in the vibrator chamber with 1" machine screws inserted through back of body.

The stationary contact is made by drilling and twisting a piece of sheet steel, as shown at figure 6. Solder or rivet a silver contact to the end, as shown. Secure the stationary contact to the side of the vibrator chamber with wood screws, so that its silver point will make contact with the one on the movable contact. Connect a piece of No. 24 magnet wire to the contact strip and run this wire and the remaining coil lead through the ⅛" hole in the lower end of the body.

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## Who Said Animals Are Cwazy!

[*Continued from page 93*]

For the torso and forearms use 7/8" stock and cut to pattern shown. Run 5/16" slot as indicated by dotted line to form arms and drill hole to receive wheel axle. Make two each of the leg and thigh patterns. The thigh is 1/4" stock slotted at one end to receive the leg which is 1/8" stock. Allow sufficient room for easy knee action.

Turn a grooved wheel to the dimensions shown and drill for center peg which should be a snug fit. Drill peg on both ends for picture hooks. Shape head from 1/2" stock and peg to torso using 1/8" dowel. The tail is wound from a heavy wire (a heavy duty wire coat hanger will do), flattened at one end and drilled for two small screw holes through which it is fastened to the body. Kink the tail slightly so that it will clear the wire that the wheel travels on. Wind up the other end of the tail in the form of a scroll.

### High-Stepper From Down Under

The kangaroo is perhaps the simplest of the three. This long legged herbivorous marsupial mammal (Macropus ualabatus) will follow its owner in a series of hiccoughing hops that are highly hilarious.

Materials required: Quarter-inch stock and several small lengths of 1/8" and 1" dowels.

Lay out the body of the kangaroo according to the pattern on 1/4" stock and cut with jig or coping saw. From a 1" dowel, cut two pieces 1 1/2" in length and glue to each side of the body to act as spacers for the hind legs. When the glue has set, drill a 1/8" clearance hole through the center of the dowels.

On a double thickness of 1/4" stock lay out the pattern of the fore and hind legs. This will enable you to cut both pairs at the same time and insure uniformity. Sand the edges carefully paying particular attention to the hind legs whose curved surface should be smooth and flowing.

Assemble by inserting a 1/8" dowel and glueing the hind legs at opposite ends. Be sure to match the position of the rotating legs and allow sufficient clearance between the spacers for easy action. The dowel at the paws will serve for tying on a pull string. Paint the portions indicated by the shaded line a golden brown and the rest in a soft underbelly white.

### A Playful Pup

Then there's the dachshund, who shakes his head, flops his ears, wags his tail and scampers on all fours as he is pulled along.

Materials required: A short length of two-by-two, several scraps of 1/4" and 1/8" wood, two small coil springs, some dowel pins and a couple of upholstery tacks.

Turn a wooden cylinder to a diameter of 2" by 9" in length. Through the length run a 5/16" groove 1" deep. Slot the cylinder to the dimensions shown for the head piece. Drill holes for leg axles and peg for tail spring. For the headblock use 1/4" stock, slot underneath to receive connecting lever and drill as indicated. The head is turned in the form of a cone with a spherical base with a slightly rounded tip. The ears are cut from 1/8" stock and attached to the head so that they swing freely.

The fore and hind legs are of 1/4" stock cut to the pattern shown. The forelegs are slotted to receive 1/8" wooden wheels to reduce the friction of the reciprocating motion. For the tail, taper a 5/16" dowel at one end and turn a shoulder at the other to fit into tail spring.

The hind legs are fitted with short lengths of 1/8" dowel, one end of which is glued to the leg and the other to the cam that actuates the lever that rides within the groove. The two halves of the cam are connected by a short dowel glued into place. The connecting lever should ride easily between the cams.

Assemble as shown in the perspective drawing.

## Bromoil Effects In Enlarging

[*Continued from page 121*]

longer exposure will be necessary when making the enlargement. This can best be determined by making a few preliminary tests.

The resulting enlargement, made through this paper negative, will have the pleasing texture shown in the accompanying photos. This texture is actually the enlargement of the paper grain through which the light had to pass during the printing process.

The effect is ideal for enhancing the quality of portraits, scenery, pastoral scenes, etc.

## Toys From The Workshop

[*Continued from page 119*]

in position. Give the entire toy two coats of shellac, with light sanding between and after. When dry, paint with enamel.

The buggy has four 7" diameter wheels cut from solid stock 3/4" in thickness. Drill six holes around each wheel and half-inch holes through the hub centers for the axles to pass through. Ends are cut from half-inch wood and sides; bottom and the two handles from quarter-inch plywood. Drill holes through the sides to carry the axles; similar holes are needed through the handles. Nail these sections together. Glue a dowel 11 1/2" long into the handles. Cut the two axles (dowels 14" long) and drill a small hole at right angles approximately one-half inch in from each end. Slip axles through sides and wheels, then glue eighth-inch pegs into the ends to hold wheels.

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## Ideas For Service Men

[*Continued from page* 107]

it into effect. In that event you'd all profit by it, especially you fellows overseas. It comes from M. Kolesar, Ylc, USNR, Navy Recruiting Station, Philadelphia, Pa., and reads as follows:

"Service men and their families might benefit from this idea regarding V-Mail. The War Department now allows pictures of new sons and daughters to be *printed* on V-Mail and forwarded overseas. This, however, entails the cost of an engraving, plus that of a printer for making the impression. If photographic V-Mail paper could be produced—identical with the letter now used—negatives could easily be projected on the paper by any amateur or professional photographer at a minimum of time and expense."

## Invisible Writing

[*Continued from page* 130]

inks you will want to advance to more detailed methods. A weak solution of copper becomes red when heated, while a very dilute solution of perchloride of copper gives invisible characters that become yellow through heat. A note of warning here: when using acids, never pour water into the acids; always pour the acids into the water. Heat is generated when water is added to an acid and if water is added too suddenly an explosion may result.

There are also invisible inks with which the characters are brought out under the influence of light. Invisible writing with chloride of gold only appears as long as the paper is exposed to daylight, and only for about an hour. A secret fluorescent ink can be made by mixing sulphate of quinine with water, and characters written with this ink become visible when placed under an ultraviolet light.

Some of the more complicated secret inks require chemical reagents to bring out the characters. For instance, characters written with rice water become blue by the application of iodine, sulphate of copper in very dilute solution will produce an invisible writing which will turn light blue by vapors of ammonia, and characters written with a very weak solution of chloride of gold turn dark brown upon passing a solution of perchloride of tin over them.

If some of your inks fail the first time or two don't give up; experiment is what makes this hobby fascinating. The more you delve into the secrets of invisible writing the more interested you will become, and also, unlike most hobbies, you can pursue it to your heart's content at very little cost.

In the course of your experiments, if you discover an invisible ink that requires a very complicated formula or formulas to bring out the characters—in fact so complicated that you are sure you are the only one who knows the secret—tell Uncle Sam about it.

## The School Shop

[*Continued from page* 105]

one is, then, an even cloud sheet or lay forming at moderate altitudes.

6. *Stratus*—This is a simple one. A cloud sheet forming at a low altitude. It might be calle an elevated fog.
7. *Stratocumulus*—In this case *strato* mean *low* family as well as sheet cloud, and *cumu lus* means tufts of cloud. This formation i a sheet or layer of tufts forming at low altitudes. Very little sky shows through the layer which usually will blow into lon dark, threatening rolls.
8. *Nimbostratus*—*Nimbo* means rain and *str tus* means sheet cloud of the *low* family. A tually, any cloud layer from which rain falling belongs in this classification. It means poor visibility and low ceilings to the pilot.
9. *Cumulus*—This is the most beautiful cloud of all. It is a tuft, white, billowy, whipped-cream like appearance, indicating bumpy flying for the pilot. When large in size, th base will be dark because of the inability c the sunlight to penetrate its mass. Belonging to the *vertical* family, its base can float at 1,500 feet, while its head can extend into the icy *cirrus*.
10. *Cumulonimbus*—*Cumulo* for tufts and *nimbus* for rain. This cloud is the daddy of them all. Its shape is somewhat like that of an anvil, with a black base and a towering, pure-white top reaching almost to the stratosphere. Its common name is "thunderhead" for it heralds the approach of stormy weather. When you're flying around the sky and you spot one of these babies, give it plenty o room. Vertical winds in its center can reach a speed of well over 100 m.p.h. and its head usually is filled with hailstones whirling around at a dangerous rate. Don't get caugh in one if you wish to keep healthy.

With this information, try your hand at cloud-spotting. Don't be discouraged if at first you see some types you can't classify. First decide upon their altitudes to determine the family part of the name, and then their shapes to determine the rest of the name. I have not included all the members of the families in the list I have given you; only those which will be most important to you as a pilot. Later we'll learn how they form and the weather conditions they indicate.

Next month we will have our second lesson on Meteorology: Lesson 13—*The Ocean of Air*, in which we shall study atmospheric pressure, temperature, dew point, etc. Be sure to add it to your file! Study up on your Navigation lessons! There's an exam coming up very soon.

---

Production of synthetic vitamin A is in the laboratory stage.

---

Used as linings for food containers, vinyl resins are expected to release tin for other uses.

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## Your Post-War Workshop

[*Continued from page* 94]

the bench is a drawer cabinet with fifteen small drawers and two larger ones. Any man who has a workshop of this type can tell you how worth while it is to make and have these drawers; the making of them alone is an interesting project and you really can go "into production" on your small circular saw. You may want more or perhaps you can do with less, but we never yet have seen the workshop where there were enough bins, cubbyholes and drawers to take care of the "stock" that accumulates.

The larger shop shown is suitable for a basement corner. Considerably more drawers of various sizes are used, and in the corner is arranged a large, double-door tool cabinet where you can make nice racks to keep your saws, chisels, bits, planes and other tools. Directly over the right-hand bench and under the drawer cabinets are bins where odds and ends may be kept. The paint shelves are at the right, together with spaces for a radio, or other electronic equipment, books, etc. Directly under this section is a combination drafting and planning table which folds down out of the way when not in use. The table has a small drawer directly over it for pencils and drawing instruments, and is illuminated by a fluorescent lamp. Under the bench are drawers and double-door lockers. One of these double-door lockers can hold your circular saw, mounted, along with the motor on a sturdy disappearing platform operating on the same principle as the familiar pull-out typewriter stands built into many office desks. When not in use the saw is simply snapped down under the bench and the doors closed. Outlets for the house current are indicated in the base board of the drawer cabinets. The vise is on the right-hand shelf where it is handy but not in the way. By placing it thus you will also get a chance to put in a long piece of material. It is always bad to have a vise up against a wall for as sure as fire you'll want to plane off a long piece of wood some day and then find no room for it.

The same thing applies to the lathe, drill press, jig saw or band saw, and you'll find it placed in the wrong spot to take work unless you have plenty of room to feed materials out as well as in. The open shelves under this power tool are for small parts, or for the attachments that might go with your power tool. In some cases the middle shelf might be used for the motor.

In each of these shops the workbench itself extends a few inches beyond the face of the lower cabinet so you can hook on a c-clamp, clamp vise or other tool anywhere you may need it. Fluorescent lighting may be arranged overhead in either shop, but such lamps must be placed carefully so that the man standing at the bench is not too much in his own light. If too close to the wall, the drawer cabinets may cast a shadow. These lamps should be directly over the bench.

## Workshop Sander

[*Continued from page* 98]

on a base as in Fig. 2 (Pc. 4) which will permit work to clear the other piece of equipment. This base is a simple 2"x4" frame with two supporting legs.

While it might seem difficult to construct a *drum*, it can be done quite easily by making use of the mount. This is the reason for building the mount before constructing the drum. A box is built of ¾" or thicker stock as shown at A, Fig. 3. Find the centers of the end pieces by drawing diagonals, and drill a ½" hole at the exact center of the two end pieces. Plane off the corners as indicated by the dash lines (B, Fig. 3). Insert a ½" shaft through the drum and secure by means of flanges (C, Fig. 3). The next step is to obtain a perfectly cylindrical drum. This is easily accomplished by mounting the hexagonal drum on the mount. Put a pulley on the shaft and belt it to a motor. By holding a coarse file or rasp so it just touches the whirling drum it is only a matter of minutes to "turn" the drum to a perfect cylinder. The adjustable top is then lowered into place and adjusted so the drum projects approximately ⅛" throughout its length. Tack a piece of sandpaper to a board and hold it against the drum. This final smoothing completes the drum.

A water solvent cement is available for attaching sandpaper to sanding disks and this method of attaching the sandpaper to the drum is most satisfactory. Since it will be necessary to replace the sandpaper frequently, it is advisable that several thicknesses of heavy wrapping paper be cemented to the drum before attaching the sandpaper. This will avoid damaging the wooden drum when removing the sandpaper.

The *disk* (Fig. 3) should be made of ⅜" plywood. Cut a circle 10" in diameter and drill a ½" hole at the center. Bolt a flange to the disk coinciding with the hole. If it is preferred not to use "spliced" sandpaper, the disk can be made 8½" in diameter, although this will provide less effective surface above the top of the sander.

As heretofore indicated, the drum and disk are assembled on a ½" shaft, which is mounted in the pillow block bearings on the sub-base. Fig. 3 shows the assembly and Fig. 1 shows the assembly mounted. If solid pillow blocks are used it is, of course, necessary to place the drum in position between the bearings and thread the shaft through one bearing, then through the drum and finally the other bearing. Collars are used to prevent shift of the shaft.

The work guide (Fig. 3) should be constructed of ¾" stock. The shaft should be approximately 18" long and slightly less in width than the 1¼" groove in the top (Pc. 2) so that it can slide easily but not too loosely. The head may be constructed as shown, with a pivoting bolt through the shaft and a slotted arc to accommodate a bolt with a wing nut. This work guide is essential in sanding end grain to keep the work at the desired angle in relation to the disk surface.

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# Indian
## MOTORCYCLES

# Your Boat's Cabin . . .

[*Continued from page* 111]

and underside, and laid in 3″ or 4″ widths; pine, spruce, fir, or redwood for a painted floor; oak, mahogany, or teak if you can afford it, if it is to be stained and varnished, or oiled. Finishing nails with puttied heads will be used for the painted floor; screws or boat nails with plugs for a floor finished bright. If linoleum is to be laid over the flooring the wood must be a grade not easily attacked by rot, and the covering should be set in waterproof linoleum paste or marine canvas cement to avoid moisture getting beneath it.

Plan bulkheads, and large locker and toilet room partitions, if possible, to strengthen the boat. If the hull is "ceiled" have strips placed atop this to receive bulkhead edges fastened, preferably into a frame, then screw-fasten the bulkhead to the latter and try to tie its top into a deck beam. Bulkheads may be plywood, which if properly tied in greatly strengthen the construction, take up a minimum of space, and give an attractive and easily-kept clean surface. Otherwise, T. & G. or shiplap edge dimensioned lumber will be used in keeping with the finish desired.

Berth fronts should match other construction with galley built-in work corresponding. The berth rail, which prevents cushions from shifting should cover the upper edge of the front. If this is plywood the bottom should be rabbeted into or go behind a base strip which may be let into any upright posts or butt against bulkheads. Several types of space-saving berths are shown in the sketches. The space behind the berths can be utilized in different ways. Simplest is the shelf arrangement with rod beneath for hanging blankets. More complicated to build, but fine if you have room is the locker layout with hinged front panels forming a backrest. These may be left bare, when finish should be in keeping with the rest of the woodwork, or it can be upholstered.

If a locker can be worked in for hanging clothes it will be found a much better arrangement than hooks. It is often possible to work in a pair of 10″ clothes lockers between any forward berths and the rest of the cabin layout, with a sliding curtain rigged to give privacy.

Toilet room layout depends largely on the size of the boat. If space is limited the best plan is to have it merely 2-ft. wide to take the toilet fixture, perhaps with a lavatory above it.

The galley calls for consideration in itself, and the smaller the boat the more carefully must the space be utilized. Sink, stove, and storage are the three essentials, with an icebox if there is space for it. If not, a small picnic-type ice chest can be placed forward, or an ice basket carried in the cockpit. Small monel metal sinks weigh little, and can easily be installed. The outlet is usually carried down and through the planking and is best discharged in the middle of the painted boot top separating bottom and topsides. If it must be carried below this to provide drainage, it is best fitted with a seacock to permit closing the outlet in an emergency.

Location of stove depends on its type. Smallest of all but reliable, safe, and capable of doing a lot of cooking is a single-burner Primus stove burning kerosene under pressure. Either this or a two-burner stove should be set into an open-front metal-lined well so a top can be dropped over it to cover it when not in use. In the average small boat the galley is in full view, and arranging it so the working parts can "disappear" makes for a more sightly cabin.

If there is room for a coal and wood-burning range of the Shipmate type, be sure to put one in as it insures added use from your boat in early spring and late fall. The smallest size will require a space 2-ft. wide but the height mentioned in a catalog dimensions can be lessened by removing the legs to place the body of the stove on an insulated platform. The stove's top should be slightly lower than the work table height, so in hot weather a liquid fuel stove can be fastened to it. On some boats the coal stove is removed in hot weather and replaced by a portable icebox, with a liquid fuel stove over it.

Anyway is better than having to stow charts rolled. On the small boat it is seldom possible to avoid folding them, but folded twice they are reduced to an easily-handled size about 18″x20″. A shallow drawer of slightly larger dimensions and a couple of inches deep will hold all the charts the average boat needs. If there isn't room to pull a drawer out the locker top may have a plywood hatch or insert to permit getting at folded charts in a shallow bin below.

A table is a necessity; a folding or knockdown type if a permanent one cannot be installed. A homemade folding-top table built to suit the boat may have a pair of legs at one end, with the other end arranged to slip into clips against a bulkhead. Sometimes the legs can be short, merely resting on the berth top with the table designed to go over the berth. Cruisers and beam auxiliaries lend themselves to the dinette arrangement, one type of which is shown in a photograph. The table top should be removable, or arranged so that the seats can be pulled together with backs dropped down to form a double berth at night.

In planning the layout of the cabin and in doing the work the final finish treatment should be always kept in mind. Paint finish is best suited to small boats, a properly worked-out color scheme giving a modern look if combined with judicious use of very narrow hardwood trim finish with natural varnished. Nails can then be countersunk and puttied, whereas with bright work plugs must be used, every piece fitted carefully, knots avoided, and sanding done thoroughly.

"Good Pictures" bring you together

Corporal Paul Kleger, United States Army Air Force, one of the many employees of International Industries now in the armed services whose wife is continuing with the company on the job of building vital war material.

Dear Mayzo: I've seen a lot of the world since I last talked with you, but none of it looks as good as home . . . those pictures you sent look mighty good to me . . .

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ANN ARBOR MICHIGAN

[*Continued from page* 129]

low ohmage can be fashioned from many things, including hard pencil leads, carbons from flashlight cells, old potentiometer resistance strips and even Christmas tree and flashlight bulbs. Their ohmage can be measured quite accurately with a simple ohmeter. Clip a lead to the centers of all strips for center tapped resistors.

You can even make a low voltage blocking or by-pass condenser by the following formula. Half the desired capacity plus 1 to the 4th decimal place equals the number of plates. Example—½ of .001 equals .0005. 5 plus 1 equals 6 plates. Plates are cut 1½" long by ⅜" wide. Cut dielectrics 1½" by 1" wide. Assemble as shown, connecting all plates on each end together by soldering. Dielectrics can be strips of thin mica or even heavy waxed paper. Bind the assembly with tape and shellac plates and dielectrics to prevent slipping when packed.

A suitable metal chassis can be made by tacking a sheet of roofing zinc all around a piece of plywood. Thus, you get strength and a complete metal grounding surface.

A good tuning condenser can be made of the book type, as illustrated. The stationary plate is a sheet of flat brass or aluminum 3" long by 2" wide. Drill a large hole in the center and fasten securely to a plywood base. Over this fasten at one end a formed piece of spring brass 4½" long by 2" wide with a hole in it that coincides with the hole in the first. Run a long bolt upright through the base so it clears the plates without danger of touching. Two insulating washers and a threaded knob serve to compress the top plate over the lower with a piece of mica dielectric between them. Two Fahnstock clips, one on each plate, are the connecting clips to the circuit. This will have a maximum capacity of approximately 200 mmfd. or .0002.

An emergency socket can be made from a square of heavy fibre or bakelite. Cement a piece of thin paper to the surface, and after pressing the tube prongs on a stamp pad press it on the paper. Drill through at these points and then file each hole to a triangular shape, as indicated. Also drill and file a key-hole in the case of an octal tube. Contact springs are shown in detail, fashioned from thin, spring brass. Each one is inserted in a hole and the flat part cemented to the top surface of the material. The socket is held above the chassis by long shims around the two screws.

By removing the resistance strip from an old rheostat and substituting a strip of thin cardboard, upon which has been drawn a ⅛" wide line of India ink, a serviceable variable grid leak can be made. The more layers of ink, the less resistance. Twist the contact arm so it bears firmly but lightly on the inked line.

A good output transformer for a receiver can be made by using an old style Model T Ford spark coil. Connect as shown in the two diagrams, screwing the vibrator down tight. This will match a 2 ohm speaker coil.

Tube shields of copper can be quickly made by rolling a piece of builders copper foil in a cylinder and catching the edges together with brass paper rivets. Connect a ground strip under the metallic lap. The copper on the outside makes a nice appearance. This also makes an effective shield.

---

One theory of hurricanes now being considered is that instead of being "one huge and terrifying disturbance moving in precise pattern around a moving center," these storms are actually an assemblage of many smaller and more violent whirlwind cyclones.


## WIN CASH!

ON PAGES 63-65 of this issue, the great MI Buildwords Contest starts. You'll want to enter it. But why not win some extra cash by getting your friends in on the contest, too?

Write your friends. Tell them about the contest. Ask them to enter YOUR name on their contest entries as SPONSOR. If one of them wins first prize, you will get $100.00 in cash! If one of them wins second prize, you will receive $50; if one of them wins third prize, you will receive $25 in cash. And there are FIVE additional Sponsor prizes of $5 each.

Remember, if you get one of your friends to enter the contest and he enters your name as his Sponsor—and if he wins one of the first eight prizes, you will win a cash prize yourself.

For your convenience, we reproduce a handy coupon below by which you may notify your friends about Buildwords. But notify as many of them as you can—for the more that enter, the better chance you have of getting that extra cash!

## WIN CASH!

Dear _____

I think you can win $1,500 in War Bonds—or at least one of 100 prizes totaling more than $5,000.00. For details, see the Buildwords Contest now appearing in MECHANIX ILLUSTRATED Magazine. You'll find it on your newsstand.

I hope you enter. For if you do, I may win $100.00 in cash as your Sponsor. Please put my name down on your entry blank as your Sponsor.

It's a whale of a contest, with no catches in it, no "slogans" to write. The highest score wins. Please enter the Buildwords Contest in MECHANIX ILLUSTRATED *NOW*.

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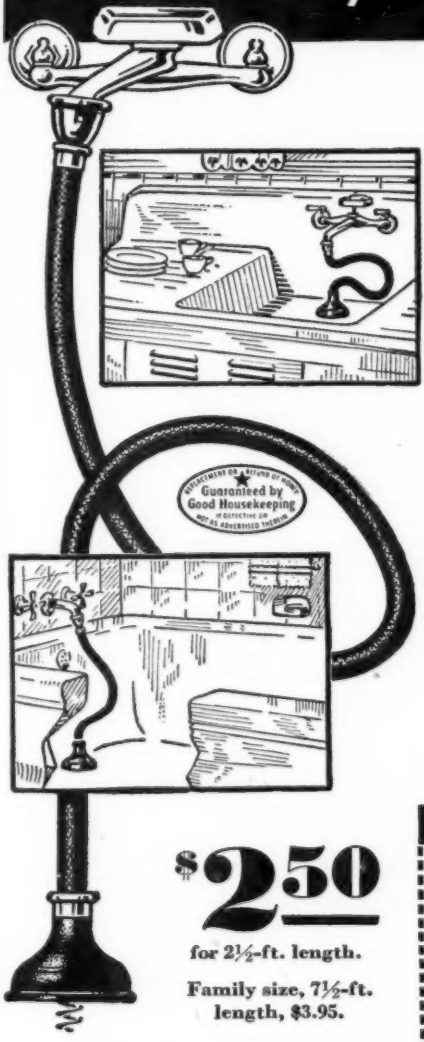


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## Cycles Predict The Future

[*Continued from page* 62]

*Society:* Swing to the right, arrogance and belligerence among minorities, race riots, class struggle, tendency for vigilante committees, K. K. K., and so on to return, increase in travel and adventure.

*Culture:* Simple, melodic, sentimental and show-off music, ornament and "gingerbread" stuff in architecture, clothing more colorful with flares and folds, laces and garish plaids and figures, poetry simple *a la* Longfellow, literature simple and descriptive, culture generally rather superficial, even plebeian and vulgar.

That is what the cycles tell us about the direction in which we are going; the clock reveals that we are now in the transition period from warm to cold. The striking connection of *weather* cycles with human activities through the centuries possibly explains, at least in part, why there are cycles running through all life phenomena.

To begin with, all energy on earth originates in the sun—the earth is a receiver of radiant energy thrown out prodigally by that giant orb. Yet the sun itself has one of the most exact cycles anywhere in nature, the 11-year sunspot cycle, and the energy it pours forth is not unvarying, but cyclic. The earth and everything upon it receives energy in long pulsations which in one era may grow tropical forests at the South Pole (as coal deposits prove) and in another era cover half the temperate continents with mile-thick ice.

This varying rhythm, therefore, seems a reasonable explanation of the fact that when the weather cycle shifts from cold to warm, human energies increase and we have periods of nation-building.

Innumerable short-term weather cycles affect human beings. In January, for instance, unfavorable weather reduces vitality and energy and paves the way for a cyclic increase in illness during February and March. School children in January show a definite decrease in rate of growth.

Whatever the ultimate cause—weather changes or fluctuations in radiation—obviously our bodies respond to cycles just as do growing trees or the advance of glaciers or the activities of nations.

A simple experiment will demonstrate this in your own case. Your efficiency varies according to a daily cycle of your own. You may spring from bed zestfully when the alarm goes off, rip off a terrific amount of work during the morning, then feel your energy waning as you skid toward an afternoon letdown and an evening sprawled on the sofa with a book. On the contrary, you may awaken sluggishly, plod through the morning, really start to get going during the afternoon, and actually be at your peak of energy after dinner.

Unconsciously, you have no doubt arranged your work so that you accomplish most during your most energetic hours of the day. You are thus acting with sensible compliance to a daily

[*Continued on page* 146]

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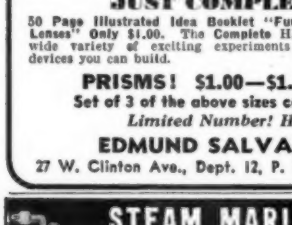


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## Cycles Predict The Future

[*Continued from page* 144]

cycle that is peculiarly of your own making.

In countless other ways, the ability of cycles to predict the future—tomorrow, or next year, or the year 1950—you can put to work to your own advantage. A market operator, for instance, would do well to know what the cycles have to say about stock prices, and if you're a fisherman it's well to know that the salmon run has a 9¾ year cycle.

In future issues of MECHANIX ILLUSTRATED, many of the cycles which scientists are identifying, measuring, and putting to work to predict the future will give you a revealing picture of startling discoveries that give every promise of taking the art of prediction out of the hands of fortune tellers and astrologists and putting it on a scientific basis.

**Editor's Note: Next month Mr. Cooley will tell you more definitely about the manner that cycles affect YOUR life and how the knowledge of cycles may help you in your daily life.**

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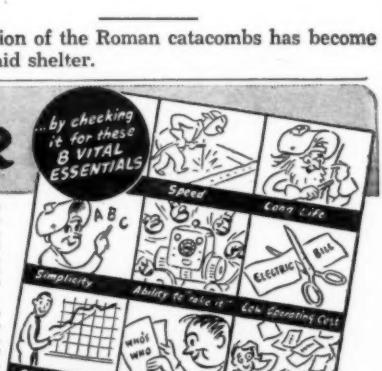

## From Hawk To Thunderbolt

[*Continued from page* 56]

So we were sent to Java to help the hardpressed Dutch. Major Charles (Bud) A. Sprague was ordered by General Brereton to organize a combat squadron from the personnel and equipment that was then available at Amberley Field, Brisbane.

There were seventeen P-40-E's ready to fly and the force was made up of seventeen pilots, seventeen crew chiefs, seventeen armorers, one line chief, one first sergeant and three radio men.

We left Brisbane on January 16th in two flights, escorted by a bi-motored Beechcraft, piloted by Captain Gunn, and two Fairey-Battles.

Because of landing accidents and the dreaded Dengue fever, we had thirteen planes and pilots instead of seventeen when we arrived on Soerabaja, Java.

The Dutch were preparing an air base for us at Blimbing near Djombing and it was ready in record time. The Dutch were slick in camouflaging their fields, giving us all good protection while on the ground during our stay in Java.

The base we used most steadily was the best camouflaged field I have ever seen. From the air it looked like the rice paddies, which were everywhere. Two of our men couldn't find it when they returned from our flight, and finally had to come down in a cornfield. The field had rows of bushes planted that looked like harmless hedges, but actually were our runways. We came down and landed on those bush strips, which squashed down gently and made an excellent runway. Jap flyers didn't find the field until the very last, when we were getting out of Java.

I didn't lose a ship there, but my last flight ended with my plane looking like grade C scrap.

One of our fighter squadron's first jobs was to take a crack at preventing the Nips from getting into Sumatra from Malaya. It was a hopeless task, of course; but we tried, not thinking it at all hopeless then. We breezed out with belly tanks, stopping off at Andir. We used 30-pound fragmentation bombs and gave the Jap landing barges a hot strafing with guns and bombs. We settled the hash of a number of barges and drowned a lot of Japs, many of whom dove off the barges in full equipment. That was worth a barrel of apples—to watch them, ant-like and frantic, trying to get out of the way of our destruction. All our planes came back safely.

On February 3rd, we had our first enemy air raid. We had only twenty-five minutes' warning and our squadron intercepted the Japanese bombardment squadron at 21,000 feet, north of Soerabaja. Because of the short warning, the bombers had dropped their loads before we got to them and caused much uproar over the Soerabaja Field. In the attack the Dutch lost seven of their twelve little Curtis pursuit planes.

The flight that contacted the bombers included Lieutenants Kiser, Stauter, Dale and Hen-

[*Continued on page* 148]


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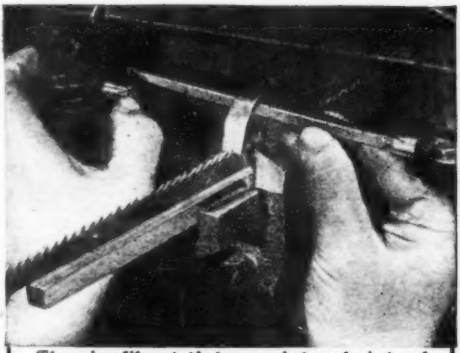

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# From Hawk To Thunderbolt

[*Continued from page 147*]

non. They chased the Japs about eighty-five miles out to sea to Baween Island. Kiser and Stauter had to turn back for lack of gas, but Dale and Hennon took a crack at the Japs. Dale made a pass at extreme range, but there were no observable results. Then Hennon struck and got a heavy bomber. The enemy bomber formation used a new type of defensive maneuver, coming into an on-line formation stacked down to the side of the attack.

Lieutenants Coss and Roland ran into pursuit ships in force about 60 miles south of Soerabaja. The Japs were flying Severskys and Zeros and there were six ships in the formation at about 8,000 feet. Even with this heavy ratio against them Coss and Roland went in after them. But as they attacked, other enemy flyers came in on their rear and Roland was shot down and killed. Coss shot down one Seversky and got away. We ended the day with a bomber and a long-range fighter to our credit, but we had lost one precious pilot and ship.

From time to time a few planes joined us, coming from various places. Three P-40's arrived from Bali—all that were left of fourteen that had started from Australia. One was in bad shape and had to be repaired, but the other two went into action at once. The flight had run into bad weather and been scattered. Their escorting plane had turned back. Four had to come down on beaches and were cracked up and the rest were caught by the Japs on the Bali airdrome and strafed, which ruined nearly all of them. Captain Lane and Lieutenants Hague and Muckley came with this outfit, and more enlisted men. Lieutenants Galliene and Parker came in by transport.

We finally had twenty-three ships with sixteen in commission most of the time, and we fought usually in four flights of three to four each, depending on how many pilots and planes were available.

On February 17th a group of eight of us was ordered out on a special mission to dive-bomb and strafe Palembang on Jap-held Sumatra. Major Sprague led us and we flew over the Java Sea. We ran into a flight of six Jap 97-Series fighters. I got one of them in the melee and so did Major Sprague and Lieutenants McCallum and Kiser. In the scrap, most of us had dropped the wing bombs which we were carrying. We had flown to Madioen a couple of days before and picked up four 20-kilobombs each, and had gone to Batavia from which we were making our flight to Sumatra.

So we were unable to carry out the mission the way it was intended. Captain Mahoney, Kiser and Hennon had kept their bombs throughout the fight, however. These three dive-bombed and we all strafed the target. Lieutenant Hannon attacked the landing barges lying in the river. We then flew

back at intervals to Batavia, Bandoeng, and the next day to our base, with no losses.

The men left at base had pretty good luck just before we returned when four flights of the squadron took off to intercept enemy bombers. The squadron met nine bombers. Four bombers and one Zero were claimed as a result of the action. A D. C., however, gave the squadron credit for all nine of the bombers. Caldwell was shot down but bailed out safely.

We got back to base from Sumatra in the afternoon. We were not there very long before we were ordered up to intercept eight Zeros. We got four out of the eight, with Lane, Mahoney, Hague and myself each shooting down one. I damaged other Zeros but had no more sure kills. The other two flights tackled the bombers which the Zeros were escorting over Java, and they succeeded in turning the bombing force back. We lost Lieutenant Fields in the scrap with the Zeros and Gilmore and Blanton were shot down. Gilmore bailed out with minor burns and Blanton was able to make a deferred forced landing in the straits of Madoera.

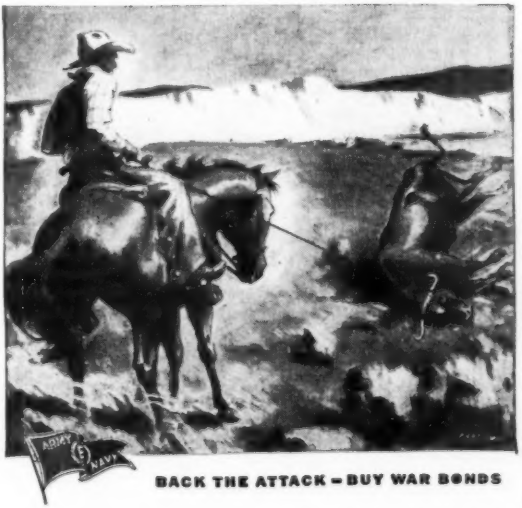
From this time on the Japanese came in steadily with great strength and our sorties, while they did damage to the enemy, were marked by greater losses to ourselves.

On February 20th, four flights escorted a squadron of LB-30's and A-24's on a bombing mission against enemy aircraft and shipping based on Bali. We patrolled above the bombers while they dropped their eggs and were under steady attacks by Zeros at 14,000 feet. While we got three Zeros definitely, one of them going on my score board, the accomplishment of the mission was overshadowed by personal loss when our squadron leader, Major Sprague, failed to report in. Some of the squadron saw him go down in a run at the target and not come back. Lieutenant Galliene was also missing and we never knew definitely what became of either of them, whether they landed on Bali and were made prisoners, or whether they crashed into the sea. They are still "missing" on Army lists. Our squadron lost four planes. Another because of damage to his elevators, made forced landing on the Java beach, having run out of gas. Major Sprague had just received his Lieut.-Colonel's commission before going on this flight, but we lost our gallant leader in his old insignia.

This is the first of two articles on the exploits of Major Kruzel. The next will appear in the March issue of MECHANIX ILLUSTRATED.


# There is no substitute for Experience

## ....in Roping or Outboard Motors

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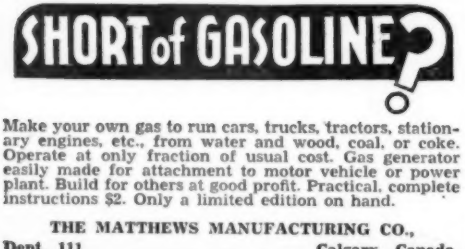
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## Adventure In Counting

[*Continued from page 70*]

III

Before those cargoes for our armed forces can be loaded faster and more accurately by this new way to do arithmetic, we must build a dozenal multiplication table. For while *3 x 3* is still *9*, *3 x 8* is now *20* (two dozen). A simple form of that table is reprinted here, but for both practice and convenience I suggest that you construct your own, on a slip of paper or cardboard that can be carried in your pocket for any odd moments when you want to play with dozenal counting. Construct the table by simple additions in each column: that is, in the *7* column, *2 x 7* is the same as *7* plus *7*, or *12; 3 x 7* is *7* more, or *19;* and so on.

Traditionalists may be troubled by finding that *7 x 9* is *53* instead of *63*, but if one started out fresh, *53* would be not a bit harder to remember than *63*. And most of the base-12 tables are considerably easier than our present tables. They are more apt to be regular (see the 3-line for example) and they come out more frequently to terminal zeros. And now to loading our ship.

Problem: What is the cubic content of a package measuring 2' 6" x 3' 6" x 4' 2"?

| | |
|---|---|
| *26* inches | *890* sq. inches |
| *36* inches | *42* inches |
| *130* | *1560* |
| *76* | *2E00* |
| *890* sq. in. | *30560* cu. inches |

To get cubic feet, divide by 1728—but duodecimally by *1,000*, which is the same as just pointing off three places—*30.560*. The answer is therefore three dozen (36) cubic feet, and five gross six dozen (792) cubic inches.

For a few other examples of multiplication, let us take our first revolving number:

| | | |
|---|---|---|
| *186X35* | *186X35* | *186X35* |
| *3* | *5* | *7* |
| *5186X3* | *86X351* | *EEEEEE* |

For some really earnest practice, take the longer revolving number given on page 70, and multiply it by any numbers from 2 through 27; all the answers will be self-proving.

Example: How many seconds in a leap year?

| | |
|---|---|
| *266* | days in leap year |
| *20* | hours in day |
| *5100* | total hours |
| *50* | minutes in hour |
| *215000* | total minutes |
| *50* | seconds in minute |
| *X710000* | total seconds |

Now *X,710,000* seconds must be expressed in 10-based numbers by the longer and more complicated 31,622,400 seconds. Such long conversions from one number system to the other are scarcely to be done mentally, however; we need

## Adventure In Counting

some conversion formulas.

To convert from 10-base to 12-base, keep dividing by 12, and the successive remainders are the proper dozenal number:

| 12 \| 365 | 12 \| 1492 |
|---|---|
| 12 \| 30+5 | 12 \| 124+4 |
| 2+6 | 10+4 |
| *Answer, 265* | *Answer, X44* |

So, there are *265* days in the dozenal year, and Columbus discovered America in Dec Four-do Four.

To convert from 12-base to 10-base, set down the units figure, add to it 12 times the second figure, plus $12^2$ (144) times the third figure, plus $12^3$ (1728) times the fourth figure, and so on as far as necessary:

| *Convert:* | *265* | *E1E* | |
|---|---|---|---|
| 5 | 5 | E | 11 |
| 6x12 | 72 | 1x12 | 12 |
| 2x144 | 288 | 11x144 | 1584 |
| | 365 | | 1607 |

This method becomes complicated for quite large numbers, where high powers of 12 are required. For such numbers it is easier to divide successively by *X* by dozenal division and take the remainders, but first we must learn how.

DIVIDE: 3 \| *36X0* — *1234*; *X* \| *47648* — *5678*

CONVERT: *115E* to a 10-base number.

*X* \| *1160*
*X* \| *142+4*
*X* \| *17+4*
*1+9* Answer, 1944

Long division is not an easy process by any arithmetic, but dozenals do simplify some types of problems. Let us go back to our army transport loaders.

Problem: How many packing cases, each containing 5 cu. ft. 160 cu. in., will go into a hold with 764 cu. ft. capacity, assuming the dimensions of the cases are known to be just right for the storage space?

5 cu. ft. 160 cu. in.=*5.114* cu. ft.; 764=538 cu. ft.

*5.114* \| *538.000* \| *106*
*5114*
*26800*
*26680*
*140*

**Answer, *106* which is 150 cases.**

**IV**

**In this and one other example we have used**

[*Continued on page 153*]

## *Practice for an R.C.A.F. Pilot*

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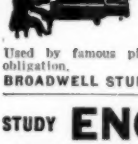

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## Adventure In Counting

[*Continued from page* 151]

a "decimal" point, which some people have thought was the outstanding advantage of counting by tens. The truth is that a fraction can be expressed by numbers after a point to any number base, and tenths, hundredths, thousandths are considerably less efficient than twelfths, 144ths, and 1728ths. Compare:

| | | |
|---|---|---|
| One-half | .5 | .6 |
| One-third | .333333 | .4 |
| One-fourth | .25 | .3 |
| One-fifth | .2 | .249724 |
| One-sixth | .166666 | .2 |
| One-seventh | .142857 | .186X35 |
| One-eighth | .125 | .16 |

In addition to the greater number of the low and much-used fractions which can be expressed exactly by duodecimals, they are usually much more accurate than decimals in expressing fractional quantities which do not "come out." Decimal percentage, for example, expresses fractions only to the nearest hundredth part; duodecimals, to the nearest 144th part.

Fractional quantities are converted into duodecimals quite as simply as into decimals, and usually with briefer or more accurate results. For examples, let us find the decimals and the duodecimals for 1/8; 1/7:

| | | | |
|---|---|---|---|
| 8 \| 1.000 | 8 \| *1.00* | 7 \| 1.000000 | 7 \| *1.000000* |
| .125 | .16 | .142857 | .186X35 |

In these examples both systems express ⅛ with complete accuracy, but decimals require one additional place. Neither system expresses 1/7 with complete accuracy, but the six-place repeating duodecimal, *.186X35*, is a closer approximation than the nearest decimal of six places, .142857.

That curious shorthand of mathematics, the logarithm, is also available in dozenal arithmetic. In 1938 George S. Terry published his *Duodecimal Arithmetic*, including logarithmic and trigonometric tables which are now available to the dozen base for the first time in history. Still other pathfinding jobs remain, however, in this newest adventure in counting.


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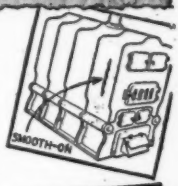

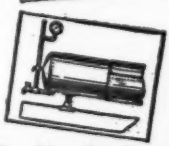

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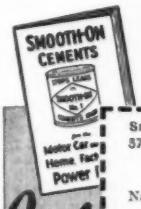


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## Your Invention Clinic

[*Continued from page* 12]

ANSWER: *A good many inventors mistake mechanical advantage for horse-power. Every physics text will illustrate that by no combination of levers will horse-power be increased.*

*On the other hand, it must be remembered that the action of any conventional engine does not permit for the fullest application of the developed forces.*

*The gear which you propose to embody in the engine is not new. Its application in any internal combustion engine seems to be unusual.*

*The entire proposal impresses us as a gambling venture with the odds against you. We would recommend most severe experimental development and search before investing funds in an enterprise in which there is but little opportunity of reaping a reward.*

### A. C. Storage Battery

A/C Bernard J. Riley, Jr., Seymour Johnson Field, North Carolina, submits a plan for charging storage batteries directly from alternating current.

ANSWER: *We do not believe that this plan will work. We cannot see where a needed rectifying action will take place.*

*You can test this out for yourself. You can make an experimental battery from pieces of lead or use the plates from a discarded battery. The other element is readily available.*

## The Gas Turbine

[*Continued from page* 41]

explosion turbine and the Velox pressure-fired steam generator, early designers of axial-flow compressors were dismayed by the results of their first efforts. Their machine used up every last jot of its power to run the compressor! They had on their hands a machine which performed with silky smoothness—and with an efficiency of exactly zero. No matter what alloys they used, they couldn't develop a turbine blading that would stand up under temperatures much above 1,000 degrees. But the vapor temperature couldn't be kept under that ceiling without producing great volumes of compressed air.

It seemed to be a vicious circle, and the pioneer designers were stymied. It wasn't until a few years ago, when the latest advances in aviation propellor design were applied to the shaping of rotor fins, and ingenious new alloys were developed, that the hurdle was leaped. While the nature of the new metallic mixtures is a closely-guarded war secret, it is known that they will permit temperatures higher than 1,200 degrees. Experiments are now under way to tackle the heat problem with air-cooled hollow blades, and arrangements by which the surface of each blade is enveloped in a boundary layer of cooling air.


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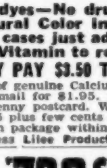

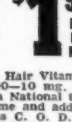

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## Model T Of Helicopters

[*Continued from page* 49]

problems. He is convinced that the Germans have been going places with military helicopters, and he emphasizes the urgent necessity to keep ahead of them in this field. As far back as 1932, he points out, the Focke-Wulf interests in Germany had a successful machine, with two props laterally disposed (Platt-LePage got the American rights for this model). And just recently the Germans were reported to be using an oversize type of helicopter on the Russian front as an aerial crane or flying jeep. This ship, consisting of rotor, engine, and bare framework, functions as a self-propelled skyhook, picking up ammunition, light cannon, radio equipment, fuel, and similar loads to be transported across rivers, gorges, and other natural obstacles to free ground movement. PV now has a similar job under design study, one that can lift eight to ten tons of payload. This aerial lift, however, is not intended for commercial passenger service, being designed specifically as a shuttle to ferry trucks and light equipment for the armed forces. It's nothing but a crane with rotors.

## Weapons And Works Of War Prominent Among Patents

Weapons and other works of war occupy front rank positions in the parade of new patents issued by the U. S. Patent Office here. They range from things as modern as jeeps and airplanes to one that comes out of the Middle Ages with the aura of William Tell upon it—a crossbow, no less!

If you see a jeep (or peep) rolling up toward the front with a load of soldiers, or ammunition, or grub, and then come rolling back again after a couple of hours as an ambulance bearing wounded out of the fight, don't be astonished. It will only be one of the convertible vehicles invented by Byron Q. Jones, an Army officer, who has turned over his patent (No. 2,278,450) for the use of the government, without payment of royalties.

Specifically, the invention is of the vehicle body, rather than of the whole car. Key to the arrangement is a series of slotted panels, which can be slid in and out, to make the handy little gas-buggy, by turns, a troop carrier, a light truck, an ambulance, a radio car, a trench mortar unit or an anti-aircraft machine-gun unit.

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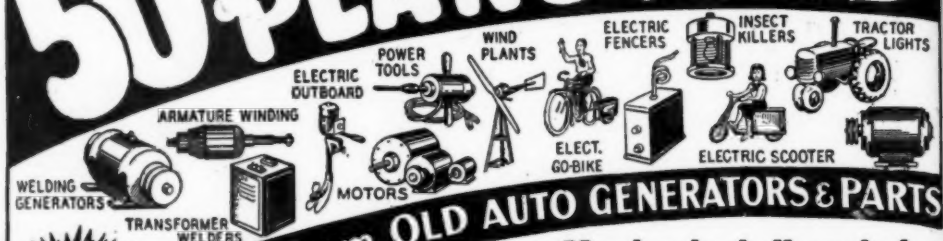


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